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THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A CONSTRUCTIVE ABILITY TEST

TRUMAN LEE KELLEY

University of Texas.

Contributions from the University of Texas Educational Laboratory, No. 8.

The number of tests which have been devised to measure general and specific traits of intelligence is so great that any new test which calls for a hearing may properly be expected to measure a new trait, or an old one more thoroughly. Before making such a claim for the present offering, a brief survey of somewhat similar tests is in order.

Many tests have been drawn up specifically with a view to securing a procedure which would not be dependent upon language, nor affected by preceding training. A test cannot be entirely free from environmental influences, but several have been contrived which are independent of preceding school training and familiarity with English or any other particular language. Manipulative and constructive ability tests in the main meet these conditions. The Sequin-Goddard form board, Fernald-Healy form boards, Healy puzzle box, Healy picture completion test, Thorndike-Stenquist constructive ability test, and many of the tests used at Ellis Island, for example the Knox cube test, are of this nature.

All of these tests are alike in that they measure the capacity of the child to accomplish an assigned task. In every case the end is set by the experimenter or by the test. As tests, the object of which is to solve a given problem, they are excellent, but they do not measure the ability to initiate a problem.

The constructive ability test here presented attempts to measure the ability to initiate as well as to execute a task. With such an object in view, the end cannot be set for the child. Another requirement of a useful test is that it shall be capable of accurate grading and standardization. It has therefore been attempted to devise a test which (1) is free from dependence upon language, (2) is free from preceding formal training, (3) tests initiative as well as manipulative ability and (4) is capable of objective grading and standardization.

It may seem that the condition permitting objective grading and the one allowing for individual initiative are mutually exclusive. This has been the point of greatest difficulty in devising the present test and the means of grading it. The test and procedure finally evolved aim to meet both conditions.

The aim has been to have material that would test a wide range of material ages; that would give the minimum of familiarity, yet ample opportunity for building; and, finally, that would be so limited in amount that the time necessary to give the test would not be prohibitive. Each of these points was the subject of careful preliminary investigation, and the resulting was the selection of the test material shown in Plate I, and the adoption, as a time limit, of twice as many minutes as the child is years old. (In case of exceptional children twice the mental age is allowed.) In case the structure is completed in less time, and the child shows no interest in further building, he may be allowed to stop.

In giving the test the material is placed before the child, who is instructed in his native tongue, "to build the best thing he can and whatever he chooses." A number of children tire of building after a few minutes and accomplish little thereafter. In such cases the best attempt is the first or second. Usually the merit of the second or third structure started is the highest and in very few cases would added time for building result in securing structures of greater merit. Ten minutes for a five-year old is ample time, forty minutes for an adult or twenty-year old may be a trifle short, but by that time enough has been built to judge of the probable merit of the structure which would have resulted with slightly more time. With boys fourteen years of age the best structure built has usually been completed by the expiration of twenty-two minutes, so that twenty-eight minutes seems an

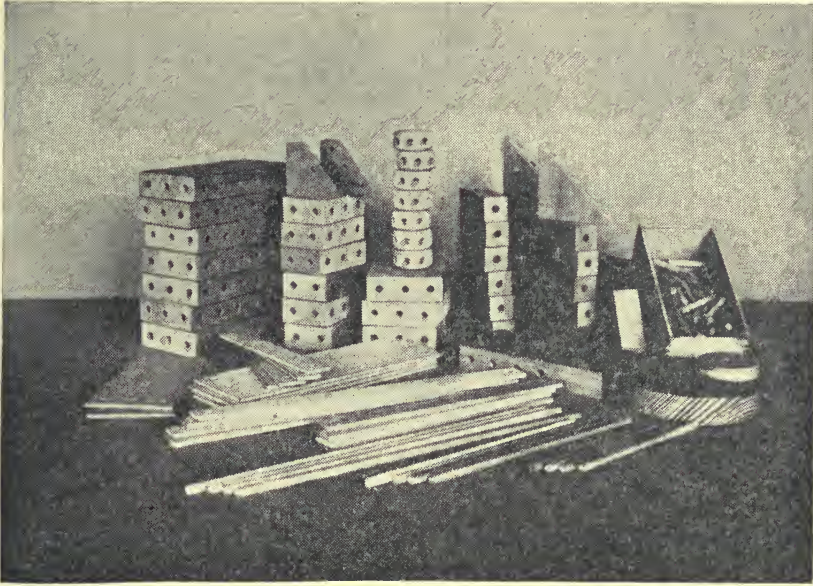


PLATE I. TEST MATERIAL

ample maximum time. Structures that are incomplete because of lack of material are not to be graded as high as structures incomplete because of lack of time. The former incompleteness is due to poor judgment in not recognizing the limitations of the material, while the latter may be due to the complexity of the structure conceived. In general the latter situation will arise only when an elaborate structure is started near the end of the allotted time, for the material is too limited to permit of many structures of such complexity that they cannot be built in the time allowed even to a ten-year old child.

The record blank for the test is shown in Plate II. Under "History" is to be entered notes obtained from the child as to blocks and building outfits that he has owned or played with extensively in the past and as to vocational or manual training experience that might be expected to have elements that would transfer to the test situation. The time of starting the test is recorded immediately following the word "time." As soon as the first structure started is completed or abandoned the time is

PLATE II.

Name..... Age..... Date of birth..... Date..... Grade.....
 History.....

Time						Final time
Purpose	1.	2.	3.	4.	5.	
Dominance of purpose						
Symmetry						
Interest in building (b), or playing (p)						
Merit						
Is structure complete?						

Notes: (What is lacking, etc.).....

Examiner.....

RECORD SHEET

recorded at the top of column 1. Sixty seconds after giving the child the blocks he is asked what he is going to build and his answer recorded opposite "purpose." If the child sticks to his original intention until his structure is complete or until the time expires he is graded high in the space left for "Dominance of purpose." The following words, or numbers corresponding, may be used in the grading: excellent = 5, good = 4, fair or average = 3, poor = 2, very poor = 1, no purpose = 0. The symmetry of the structure is graded using the same scale, no discernible symmetry equaling zero. Simple structures that give little opportunity for a symmetry, such as wagons, are generally to be graded "average" or "3." In the space left for interest is to be placed "b" or "p," according as the child is interested in building or playing aimlessly with the blocks. The large wheel shown in Plate I has been included in the material for the sake of having something that serves as a distraction from building and suggests playing. It does not lend itself readily to appropriate use with the other material, though, as Plate VIII shows it may be used with very excellent results. The merit of the structure built is determined by comparing it with stereoscopic photographs of structures which have been carefully graded, as will be explained. In the bottom space of the first column is recorded the child's statement as to whether or not his design is complete. As many columns 1, 2, 3, 4, 5, are used as there are attempts at building. It seldom happens that more than five columns are needed for a test. Notes as to causes of incompleteness of structures, attitudes of the child toward the work, his interests, his fixed ideas inhibiting variation and richness of conception, his dexterity, and his type of imagination are recorded in the foot-note or on the back of the record sheet.

The most important, because the most defective, element in the record is the grading of the product for merit as a structure indicative of constructive ability. In order to grade such varied structures a scale of forty stereoscopic photographs has been worked out. Ten judges have contributed to the evaluation of the merit of the elements of the scale. Two students and the writer ranked 250 photographs of structures built by normal and subnormal boys. From this number 54 were selected on the basis of their location in the entire series and given to eight judges, members of the education and engineering faculties of the Uni-

versity of Texas, to rank. The percentage of judges ranking one structure (stereoscopic photograph) above another determined the distance apart in the scale of the two structures. The general method followed in making these calculations is not here described, but is the same as that used by Thorndike in deriving his handwriting scale.¹

From this scale of 54 samples certain ones were dropped because they were types of structures not needed in the part of the scale corresponding to their values. The resulting scale consists of 19 samples of buildings of various sorts, mostly houses, 12 of vehicles, and 9 of machinery, including aeroplanes and the like. The reliability of the scale is high. The grades given to the samples would correlate with other scale values, derived in a similar manner from the judgments of other equally competent judges to the extent of .98.

The probable error of judgment when a single judge grades a single structure is approximately 6 of the scale units, which is about $\frac{1}{8}$ of the range covered by the scale. Expressed in another way, the correlation between an individual's placement of a large number of samples and the true placement in the scale is .92. Practice in grading as few as 40 or 50 samples materially increases the accuracy of grading, decreasing the probable error of judgment by as much as one-half.

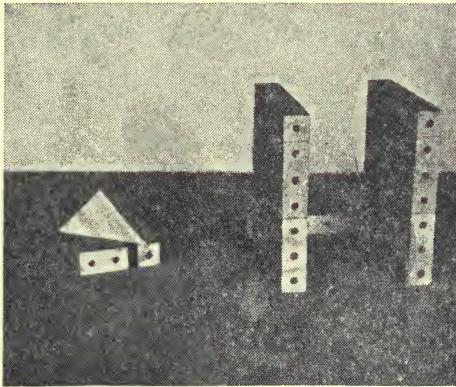
¹EDWARD L. THORNDIKE. *Handwriting*. Teachers College Record, Vol. XI, No. 2, March, 1910.

A minor variation from Thorndike's method is in the weighting and averaging of various measures of difference. If $a, b, c, d, e, f, g, h, i$ represent samples in decreasing order of merit the distance between samples e and f may be calculated in nine different ways considering the neighboring four better samples a, b, c, d and the four poorer g, h, i, j . The percentage of judges ranking e above f gives one such measure of difference $De-f$. The percentage ranking d above f gives the difference $Dd-f$ and the percentage ranking d above e gives the difference $Dd-e$. $Dd-f - Dd-e = De-f$. In a similar manner seven other values of $De-f$ may be obtained. The probable errors of these differences were calculated taking, as a sample the rankings of twenty structures located near the middle of the scale and found to be proportionate to the numbers given below:

		Weights
P. E. of	$De-f$	
" " "	$Dd-f - Dd-e$ or of $De-g - Df-g$	= .1916 5
" " "	" " $De-h - Df-h$.3152 3
" " "	" " $De-i - Df-i$.4092 $2\frac{1}{2}$
" " "	" " $De-j - Df-j$.4740 2
" " "	" " $De-f$.5034 1.9

These nine ways of calculating the single difference ($De-f$) were averaged, after first weighting as shown, inversely as their probable errors, to give the scale measure separating the samples e and f .

The lowest structure in the scale was originally intended to be a structure of zero value. It was obtained by tumbling the blocks out of a box and selecting the combination that looked most like a structure of some sort. In reality it required no ability to build, but since it looks as though it might be something it seems to have a little accidental merit. It accordingly is not graded zero, but 2, which is the writer's judgment of the distance it lies above a structure of genuine zero merit. This sample is the only one actually built by a boy. Plate III shows it and the one next higher in the scale. Having the scale it then became necessary to establish norms that results might be interpreted intelligently. In doing this the question immediately arose as to whether past experience of various sorts would lead to greater proficiency with the test material.



NO NAME, MERIT 2. HOUSE, MERIT 14

PLATE III.

Thirty-seven children, selected because of experience with metal building outfits, Tinker-Toy blocks, or in manual training, showed an average superiority of nearly a year, at age 14, above children not so experienced. Substantially all of this difference was contributed by children having had, or taking, manual training. There was no evidence that experience with metal building outfits and Tinker Toy blocks helped in the Constructive Ability test. As it is reasonable to think that those who take manual training in the high school are a group selected in large part because of their interest and former ability along

mechanical lines there is no certain, or even probable, evidence that success in the test is not determined solely by native interest and ability. Considering alone the group who had had or were taking manual training it is evident from the data at hand that they stand nearly two scale units above other high school boys of the same age. From *a priori* grounds, based upon similarity of function there seems less reason to think that elements in manual training work would transfer to the test situation than would elements from play with metal and Tinker Toy outfits. As there is no evidence of transfer in the latter case it is added evidence that the difference mentioned, of two scale units, is due to the selection of a group natively more capable along mechanical lines and not due to training. Because of these considerations the norms so far as at present drawn up are based upon the records of all boys examined and not of those only who had had no preceding experience in manual training. Approximately one-quarter of the fourteen year old group were taking manual training when tested. It is not popularly thought that high-school boys are superior to non-high-school boys in mechanical ability. If, however, their constructive ability should differ from that of boys in general the norms here given would on that account be those of a select group.

Three groups of school children, proclaimed "normal" by the principal, were tested, giving the following results:

36	boys,	avg. age	8.08,	built	structures	of an	avg. merit	of	44.9,	
										P. E. of avg. = 1.23
33	"	"	12.05,	"	"	"	"	"	"	58.0
										P. E. of avg. = 1.39
33	"	"	14.23,	"	"	"	"	"	"	60.8
										P. E. of avg. = 1.47

Boys of ages eight and twelve were chosen to give points for the upper limits of imbecility and moronity, while the age 14 was chosen to carry the scale into the higher ages. The three points shown by stars on Plate IV are the points thus experimentally determined. The curve shown was drawn through these three points to give norms for other ages. It, of course, is an approximation, to be supplanted by actual test records as soon as they are available. The three points determined have considerable reliability as their small probable errors indicate. These three

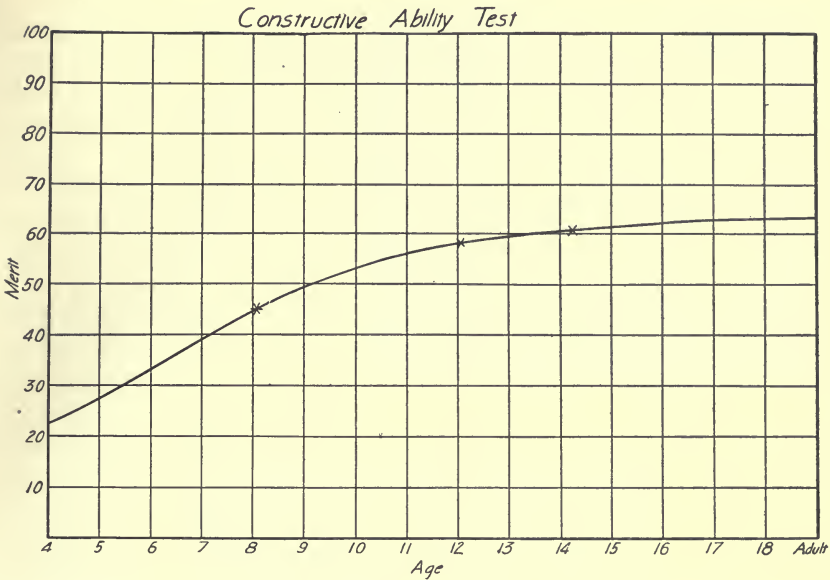


PLATE IV.

points are sufficient strongly to indicate a curve of the type generally found in the development of intellectual capacities. It is a typical growth curve with the greater part of the increase coming before adolescence. The points at which the curve cuts the ordinates for the different ages give the tentative norms for these ages. These values are given in the following table:

Age	4	5	6	7	8	9	10	11
Mean merit in constructive Ability test	22.4	27.6	32.9	38.8	44.4	49.2	52.9	55.8

Age	12	13	14	15	16	17	18	Adult
Mean merit in constructive Ability test	58.0	59.5	60.5	61.3	62.0	62.6	63.1	63.4

The probable deviation of a normal boy's record from the average for his age is about 7.5 units; 7 for 8-year olds and 8 for 14-year olds. It may be expected that the mean grades given for ages four to six and seventeen to adult, are the least reliable.

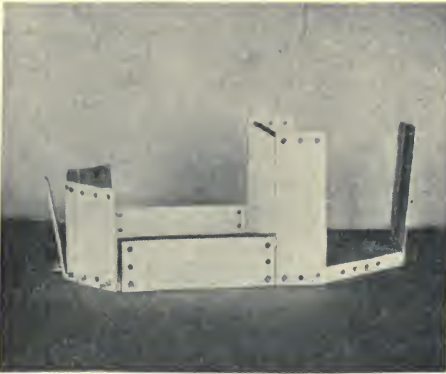


PLATE V, MERIT 46.

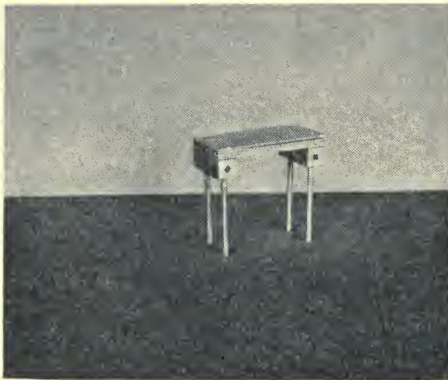


PLATE VI. TABLE, MERIT 57.

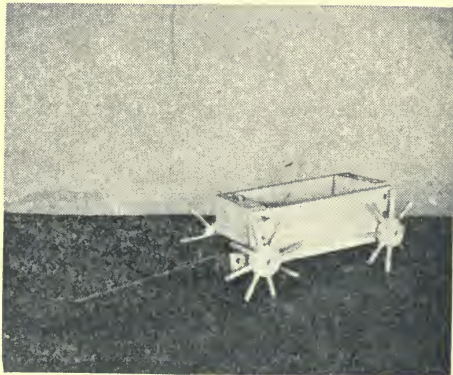


PLATE VII. WAGON, MERIT 61.

Plates V, VI, and VII show the samples in the scale which are closest to the average merits of normal eight, twelve and fourteen-year-old boys. Plate VIII is the scale sample of greatest merit. It is of such worth that structures as good as it may be expected about once out of every 60 built by normal fourteen-year-old boys.

As an illustration of the use of the test and scale, mention may be made of an examination of 250 of the boys in the Texas State Juvenile Training School for delinquent boys. In addition to the idiosyncrasies revealed, the average capacity of the boys was found to be very much less than that of normal boys of the same ages. These boys, of average age 15.26, showed an average accomplishment equal to that of the normal 9.5 year old. The average merit of the structures built by these boys is 51.3, approximately represented by Plate IX. As evidence that the test is highly correlated with mentality it may be reported that these boys showed nearly as great backwardness in such other mental tests as Binet and completion tests.

In addition to difference in merit of structures built the test reveals material qualitative differences. Questioning the boy when building as to what different parts of the structures are for, enables the experimenter to discover much as to the mental processes involved. Young children are prone to build skeleton or incomplete structures and supplement their shortcomings by an active imagination. A house such as that shown in Plate X is typical. With a young child the imagination is rich enough to be adequate for all needs and there is no feeling of incompleteness as to the structure. An older boy would be likely to observe that you would get rained on if you lived in that house. Another characteristic of the products of young children is that their buildings are usually representations of things as they are statically—their ideas frequently do not involve the idea of motion; for example, such a child built the wagon shown in Plate XI, with wheels pegged to the body and incapable of movement. The structure is a wagon without a doubt; for does it not have wheels and a body of a sort? The refusal of the wheels to turn need only worry an unfortunate adult who has not sufficient mental versatility to adjust such minor details.

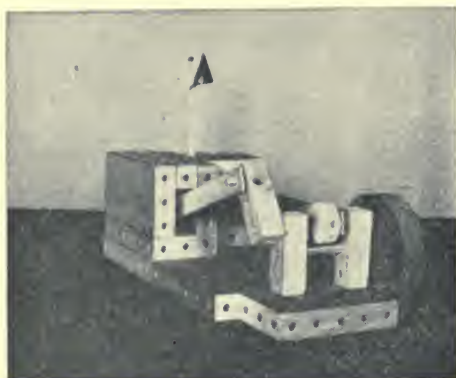


PLATE VIII. STEAM ENGINE, MERIT 93.

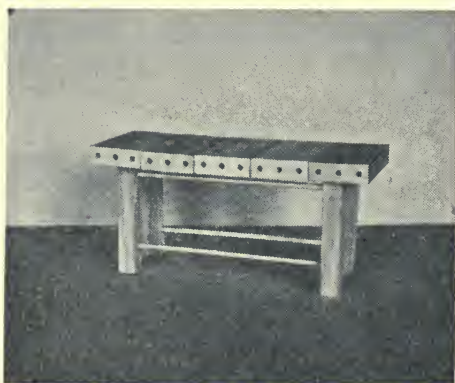


PLATE IX.

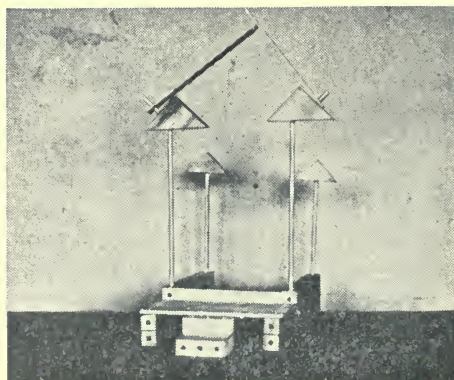


PLATE X. HOUSE.

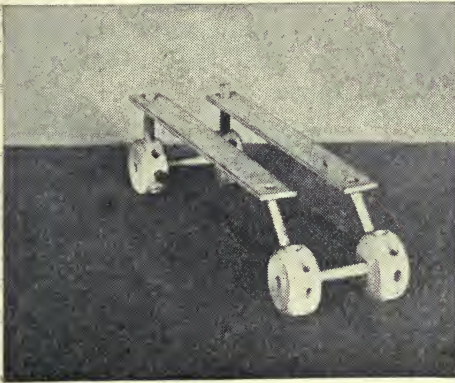


PLATE XI. WAGON.

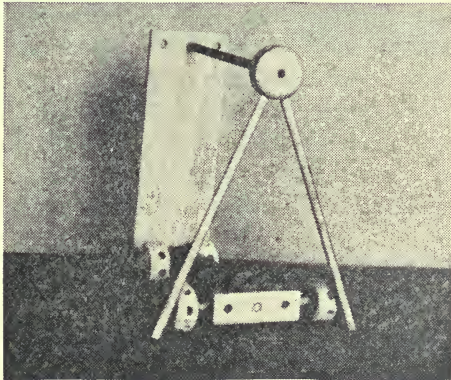


PLATE XII. BROKEN AUTO IN A GARAGE.

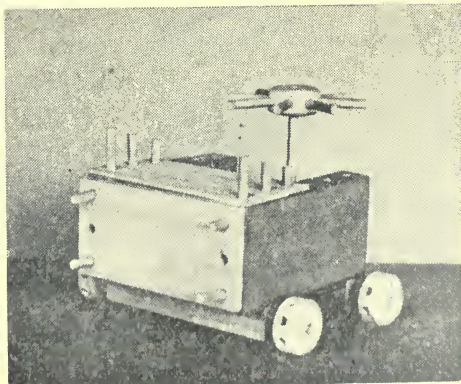


PLATE XIII. AUTOMOBILE

Plate XII, showing a "Broken auto in a garage" was built by a small boy who very prettily gave evidence of several typically childish tendencies. The garage and the automobile are mere skeleton structures, withal quite sufficient to serve as nuclei for fancy to add to. The idea that an automobile is meant to move did not occur to the boy, for it was not until pointed out to him that he saw that it was too big to go into the door of the garage, but at this point a truly liberal imagination came to the rescue for, in reply to the question, "how does the automobile get into the garage," he nonchalantly lifted the garage up and said "Oh, you just put it down that way," replacing it over the automobile.

Plate XIII is an automobile, as any child can prove, since it has wheels, a hood and a steering wheel. True the location of the steering wheel upon the rear axle might be considered slightly unique if one were to stop and think about it, but such reflection is quite unnecessary.

Plate XIV is an illustration of very good manipulative ability coupled with inadequate conceptual processes. The boy started to build a house. Becoming interested in the long rods, beams and wheels he continued to ramble on, building solidly and symmetrically. Lack of further similar material stopped him. When asked to name the structure there was some hesitation—his original intention apparently having been nearly forgotten. After a brief conflict as to whether it should be a house or a bridge he cut the Gordian knot and satisfied all demands by calling it a "house-bridge." It seems evident that this boy worked entirely devoid of ultimate purpose, though quite rigidly imposing upon himself the immediate purpose of making the structure symmetrical. Plenty of other material was available, but he "had to" stop for lack of wheels, rods and beams.

At an older age structures are very likely to be things that work—the wheels of wagons are on axles. Great care may be taken in building an aeroplane that the seat of the aeronaut is so enclosed "that the wind will not sweep him off as his machine rushes through the air."

Plate XV shows a racing automobile, built by an adolescent boy. The wheels turn, the gasoline tank is pegged on, but, keeping in mind that this machine is to travel at great speed it is apparent that the top part of the hood, due to its momentum,

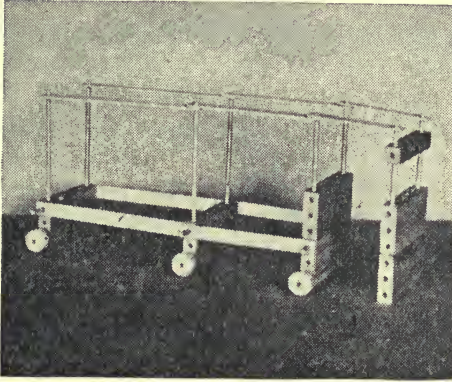


PLATE XIV. HOUSE-BRIDGE.

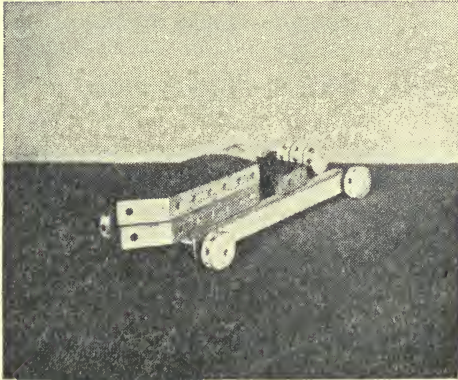


PLATE XV. AUTOMOBILE.

will fly off from the bottom in taking a sharp turn. The impossibility of pegging the two parts of the hood together to obviate this difficulty was the cause of much worry on the boy's part. The mental processes at work in the building of this racing car were entirely different from those resulting in the preceding five structures. In the main the building of adolescents is of this latter type. Eight year old boys build structures of both types, sometimes of neither, and frequently combine the elements of both in one. The discovery of spontaneous mental processes is one of the most fascinating and, withal, valuable results of the test. The interests of the children, their persistence, the mental restrictions they place upon their own procedure, and their feelings of satisfaction or exasperation with the results of their labors, can hardly be expressed in standardized objective terms, but they are all traits that the test enables the experimenter to observe.

Any number of problems are suggested by the test—the determination of sex differences; the correlation, expressed in terms of coefficients of correlation between the measures of the function here tested and other mental tests; the correlation between success in the test and vocational fitness, etc., etc. The test is particularly applicable in examining children of very different environments, for the trait measured is a creative and executive one, but slightly influenced by the ordinary past training of an individual.

For the present the writer will personally handle the material involved in this test. He will greatly appreciate records from other experimenters using it, that more adequate norms may be rapidly built up and that the test may be used more intelligently in the diagnosis of the innate fitness of youths to engage in mechanical vocations.

AGE NORMS OF PSYCHO-MOTOR CAPACITY¹

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The time will come, I believe, when no one will be so rash as to attempt a scientific evaluation or classification of the varying degrees of human mental capacity simply from a general acquaintance with the subject, or from impressions gained from a brief conversation with him, or merely from observation of his conduct, or from an inspection of his physiognomy, or from the observation of the so-called stigmata of degeneration, or from an examination for physical defects or diseases, or from an inquiry into facts of personal and family history and into the circumstances of the social and physical habitat, or from an investigation of the subject's pedagogical record.

I do not wish to be understood as minimizing the value of such inquiries, and particularly the need of wide experience, in the work of mental and educational diagnosis. Certainly very few requirements are more essential to correct diagnosis, whether medical, psychological, educational or social, than extensive first-hand experience with many mental, educational and social types. Nevertheless so far as concerns the adequate estimation of *mental* capacity, whether native or acquired, there is probably no method of investigation which will take equal rank with the method of direct psychological experimentation—that is, the study of the mental reactions of the individual by control devices. Of course, it is clear that all psychological methods of studying another's mind are always indirect and inferential—based upon the examination of the products of mental application rather than the underlying processes themselves—but the study of mental processes by methods other than psychological is doubly indirect and inferential, and therefore proportionately unreliable. It is also clear that sometimes the only method of psychological examination available is the method of inspection or observation.

¹ Delivered before the American Psychological Association, and Section H of the American Association for the Advancement of Science, University of California, August 5, 1915.

This method is by no means valueless. It may be made of considerable value for mental diagnosis, when the observations are numerous and accurate and when they are based upon the individual's behavior under normal social and industrial conditions. And yet it remains a fact that the psychological methods of determining mental capacity cannot be made scientifically precise without the use of control tests or accurate instruments, nor can the results be accurately evaluated without the use of various kinds of normal age-norms of mental development. The present discussion will be restricted to a statement of what is meant by age-norms of psycho-motor development and to a brief presentation of a few of the more important results from an experimental investigation based on the modified Seguinian form board.²

By a normal age norm of psycho-motor capacity is meant the average quantitative or qualitative, or combined quantitative-qualitative score made by normal children or adults of a given chronological age when they are incited to put forth their best efforts to execute a series of motor reactions required in the solution of a problem which demands, first, the motor ability to perform the appropriate muscular movements, and, second, the ability to make the basic intellectual analyses and comparisons on the accuracy of which depends the ability to make the correct muscular responses. When the ability to perform a motor reaction test depends primarily upon the subject's neuro-muscular or motor strength, speed or steadiness or upon his delicacy of motor coordination, and only incidentally upon his capacity for rapid and accurate intellectual analysis and adaptation, the test in question may be designated simply a *motor* test. On the other hand, a test may be classified as a *psycho-motor* test when it puts a premium upon the capacity for sensory discrimination, analysis and recognition, upon the ability to make a considerable number of associations and to retain the relationships between the various associations, upon the ability to make adaptations to a novel situation of considerable complexity, and upon the ability to execute a set of appropriate muscular movements. While it is impossible to draw an absolutely fixed and sharp line between these two kinds of tests, it is evident that, as above defined, a psycho-

²A complete exposition of the experiment will be found in my *Psycho-Motor Norms for Practical Diagnosis: A Study of the Form Board, Based on the Records of 4072 Normal and Abnormal Boys and Girls, with Yearly and Half-Yearly Norms*.

motor test is more valuable than a motor test for the purpose of grading a child's degree of mental development, for in addition to measuring motor ability as well as can be done by a motor test it also measures intelligence—*i. e.*, the individual's capacity to adjust himself to a novel situation.

One of the simplest and best tests of psycho-motor capacity is the modernized and improved type of form-board which was used by Seguin in the training of the feeble-minded.³ In order to perform this test the subject must be able to distinguish the shapes of ten different detached insets, he must be able to associate the solid forms with the corresponding recesses in the board, he must be able to memorize the locations of the recesses if he is to improve satisfactorily as a result of repetition, he must be able to grasp, convey, and insert the insets quickly and accurately, and throughout he is required to adjust himself to a situation which may be quite or wholly unfamiliar to him.

The following are a few of the conclusions reached from an analysis of the form-board records of over 4000 bright, average, dull, feeble-minded, and epileptic children.

First, there is an increase in psycho-motor capacity as measured by this test for every age investigated from two to seventeen (see the Graphs). This disproves the statement that there is no improvement after the age of 12 or 14. Moreover, there is every indication that the development of psycho-motor capacity continues to increase beyond the age of 17—how far no one has determined.

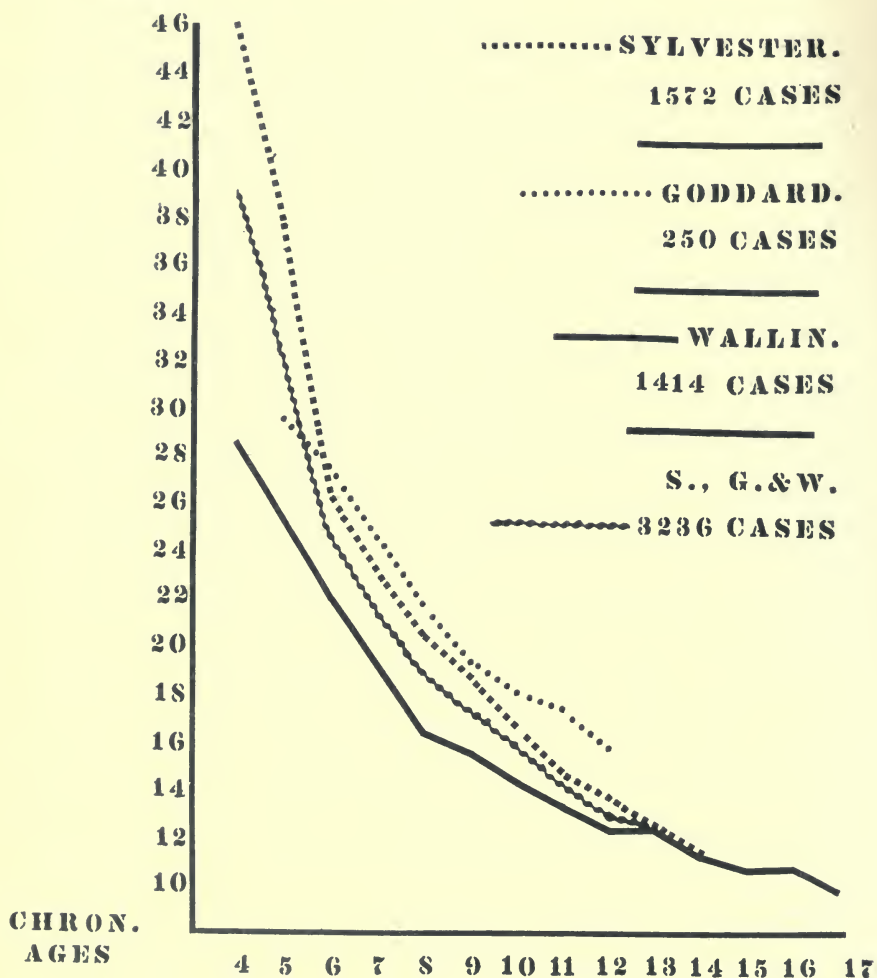
Second, it is feasible to establish not only whole-yearly (Graph I), but also half-yearly (Graph II)⁴ normal norms of psycho-motor development for all of these ages. But a closer analysis of the data indicates that the size of the steps between the successive age norms should differ according to the age of the subjects. The yearly steps are too large in the lower ages. It is advisable to utilize semi-yearly norms up to about the age of 8. From about 8 to 12 yearly norms and from 12 to 17 bi-yearly

³Number 78,002 in Stoelting's Catalogue.

⁴The half-yearly norms are so constructed that no child will vary more than three months from his age classification. Thus age 6 includes children from 5 years 10 months (beginning of tenth month) to 6 years 3 months (end of third month). Age 6½ includes those coming within 6 years 4 months to 6 years 9 months (*The Mental Health of the School Child*, 110 f). The curves in both graphs are based on the averages of the best record in three trials.

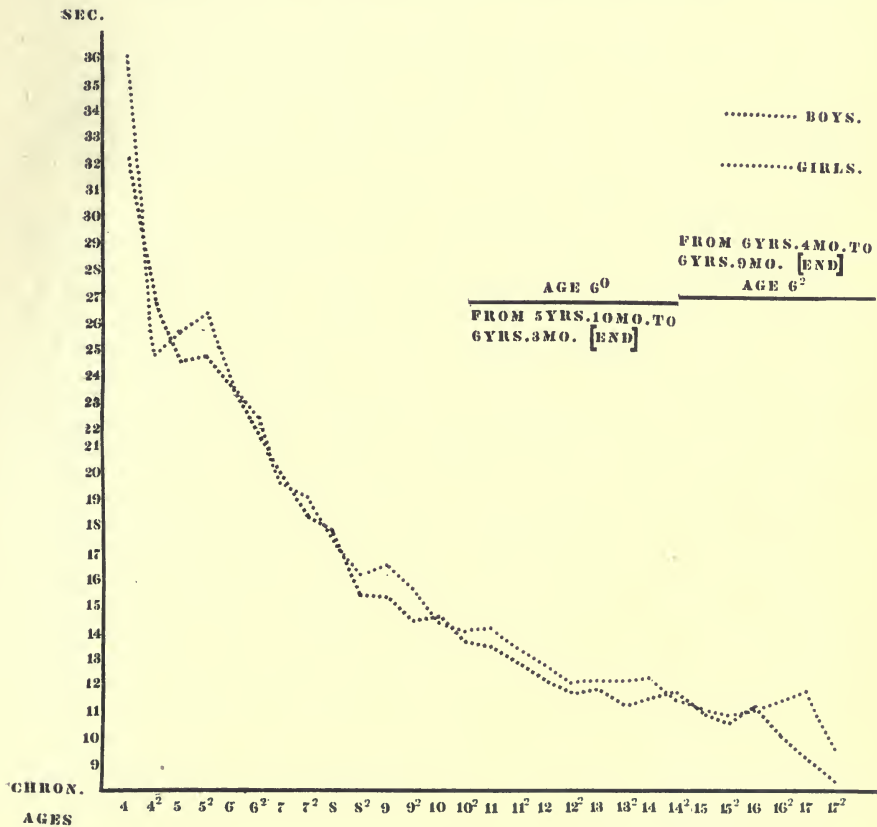
YEARLY FORM BOARD NORMS FOR NORMAL CHILDREN

SEC.



GRAPH I.

HALF-YEARLY FORM BOARD NORMS.
 BASED ON 722 NORMAL BOYS AND 758 NORMAL GIRLS.



GRAPH II.

norms seem to be sufficiently fine (no data are available after age 17).

Third, graded scales of intellectual or motor development can be most satisfactorily constructed in accordance with the principle underlying our motor scale. That is, semi-yearly, yearly and bi-yearly⁵ norms should be established separately for numerous individual traits. The lower end of the scale for each trait should be based on the performance of children so young or immature that they can just barely do the test in question. At the upper end the scale should be extended so as to include individuals so old or mature that an increase in chronological age fails to evince any additional improvement. Comprehensive scales may then be constructed by assembling age norms for a considerable variety of mental traits.

Fourth, psycho-motor capacity varies with the grade of intelligence and the type of the subject. The bright children surpass the average children, the average surpass the dull or backward, the backward surpass the feeble-minded, the higher grades of feeble-minded surpass the lower grades, and the feeble-minded surpass the epileptic. Of all types of children studied by the writer the epileptic respond the most slowly, not only in motor tests but also in various intelligence tests.⁶ Epilepsy is characterized by marked psycho-motor retardation.

Fifth, in view of the demonstrated dependence of psycho-motor ability upon degree of intelligence it is suggested that normal norms can only be secured by testing selected groups of normal children. Norms based on unselected groups would in all probability be too low, owing to the fact, indicated by both psychological and pedagogical studies, that there are more subnormal than supernormal children. The writer's normal norms are based on a selected group of children of whom 75% were classified as average, and about one-half each of the remainder as bright and dull. My feeling is that normal norms should be based on a distribution of ability which would give approximately 75% of normal or average children, 12.5% above normal and 12.5% below normal. The objection to this basis or similar

⁵The steps may, of course, be smaller in the lower end of the scale and larger in the upper end.

⁶Only a portion of the supporting evidence has thus far appeared in print: *Experimental Studies of Mental Defectives*, 1912, 67ff.

bases of selection, *viz.*, that one year of mental deficiency or excess does not signify the same thing for a young child as for an older child, while true, seems to me to be irrelevant. When we designate a child of 3 and a child of 12 as equally above normal we do not imply that they are both advanced by the same absolute unit, say 3 years. Relatively one year of advance at 3 may be just the same as 3 years at 12. But this has no bearing on our predetermined basis of selection. The weakest point about that is the difficulty accurately to select our cases in advance of the testing, as it presupposes the existence of fairly accurate standards of judging at least three categories of ability, but it seems to me necessary to adopt a more definite standard of selection than that of random sampling, *i. e.*, the testing of unselected groups. If the child is in school the school criteria, though far from accurate, enable us to exclude the greatest variants.

Sixth, the differences between my normal age norms and the normal age norms of other investigators are surprisingly large (See Graph I). The average difference between my norms and Goddard's amounts to 4.4 sec. for ages 5 to 12, and between my norms and Sylvester's, 5.6 sec. for ages 4 to 12. It is evident that wholly discrepant diagnoses will be made according as the individual is rated by Goddard's, Sylvester's or my norms. Formerly when using Goddard's norms my clinic cases almost invariably ranked decidedly higher in psycho-motor age than in Binet-Simon age; now when gauged by my norms, and particularly when gauged by the combined Goddard-Sylvester-Wallin norms, the psycho-motor and Binet-Simon ages more nearly coincide; in fact the psycho-motor age is frequently less than the Binet-Simon age. This, I believe, is in accordance with expectation, for the form-board is certainly a better test of native intelligence than many tests included in the Binet-Simon scale.

The reasons for the large differences in the three investigations, aside from the few cases on which Goddard's results are based, may be, first, the fact that my subjects may have been incited to put forth greater effort, especially from the start; and, second, the probability that I tested relatively fewer dull pupils and relatively more bright ones than either of the two other investigators.

Seventh, boys are superior to girls in psycho-motor ability (See Graph II). The average scores for the normal boys are

higher than for the normal girls in nearly 75% of the comparisons. The boys' average superiority for each whole-year, based on the shortest scores in three trials, amounts to .61 sec. The boys' superiority, however, among the subnormal cases is not very obvious, possibly because of the larger number of subnormal boys than subnormal girls, particularly in the lower grades. The boys' superiority becomes somewhat more marked with increasing chronological age (though there are exceptions), possibly because the greater maturity of the girls compared with the boys of corresponding age grows less and less as they become older.

Eighth, properly to gauge psycho-motor capacity by the form-board it is advisable to give the test at least three times; first, because the average score improves from test to test; and, second, because the effect of repetition varies somewhat according to the intelligence, type, age, and sex of the subjects. Girls make a poorer initial attack than boys and, therefore, gain relatively more from repetition. Intelligent and more mature children make a better initial adjustment than less intelligent and younger children, and, therefore, improve less from repetition; and epileptics very frequently do poorer in the second or third trials than in the first. For these and other reasons the fairest single index by which to gauge the psycho-motor efficiency of an individual by this form-board is the best record in the three trials.

EFFICIENCY IN MENTAL MULTIPLICATION UNDER EXTREME FATIGUE¹

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THE PROBLEM

In reporting the experiment of Miss Arai, in the course of which difficult problems in mental multiplication were performed without rest over an extended period of time, Thorndike points out the fallacy of assuming that to take twice as long to perform a given piece of work necessarily means a reduction of 50 per cent. in efficiency. He says: "The zero point of efficiency in the function of mental multiplication would be 'just not to multiply a number like 3 by a number like 2 in, say, ten minutes.' We do not of course know just at what point between this zero and the ability to multiply a four-place by a four-place number mentally in five minutes with only two figures in the answer wrong (as Miss Arai did at the beginning of work), we should place her ability, at the end of work, to multiply a four-place by a four-place number in eleven minutes."² And again he remarks: "With mental multiplication it would be practicable, though very laborious, to make the former measurement [*degree of difficulty*], by having interspersed in and at the close of a rigidly fixed long work-period of mental multiplication with two three-place numbers, tests in multiplying a four-place by a three-place number, a four-place by a four-place, five-place by a four-place, and a five-place by a five-place. There should also be tests with three-place by two-place, two-place by two-place, etc., in case an individual comes to fail utterly with the three-place by three-place multiplication."

¹ This experiment was conducted at the summer session of Teachers College, Columbia University, 1914, under the immediate direction of Professor G. M. Whipple, of the University of Illinois, then in charge of certain courses in educational psychology at Teachers College. Professor Whipple is responsible for the general plan of the experiment and of this report upon it.

² *Educational Psychology*, 1914, Vol. III, p. 20.

It was this last proposal that furnished the cue for the present experiment. The problem set forth was: given an individual who has succeeded by practice in multiplying mentally a four-place number by a four-place number with fairly steady efficiency: if this individual then continues without rest at mental multiplication until he is totally unable to proceed further, will his efficiency come to an abrupt end, or will it 'tail off' by degrees, so that a three-place can be multiplied by a three-place number when four-place numbers become impossible, and so on until finally he can just barely multiply a one-place by a one-place number?

THE MATERIAL

The digits 2 to 9, inclusive, were written singly on small cards. The cards were shuffled and the requisite number was then drawn to provide a multiplier and a multiplicand. The two numbers thus secured were written down and remained in sight until the experimenter had mentally performed the multiplication and written down the product. As soon as the elapsed time had been recorded, the cards were again shuffled and a new problem set. In the later stages of practice and in the final test, however, the problems were all made up beforehand, so that the mental work proceeded with no more interruption than was needed to record the answer and the elapsed time.

THE PERIOD OF PRACTICE

Mental multiplication is decidedly affected by practice improvement. To offset this source of error the experimenter worked at the task for one hour a day for fifteen days, almost invariably in the evening between nine and twelve o'clock. Approximately three days' time was given to each stage of practice—two place by two-place, two-place by three-place, and so on. The main results are shown herewith in Table I. It will be seen that at the 15th day the experimenter was doing fairly steady work with four-place by four-place numbers. Careful notes were kept of general physical condition, attitude toward the work, feelings of fatigue and similar conditioning factors. The chief trick of method that was developed was that of adding the partial products to one another as soon as they had been secured, in order to avoid the difficulty of holding more than two partial products in mind while computing the others.

THE FINAL TEST

The subjective conditions under which the final test was carried out are sufficiently important to warrant the reporting in full of the experimenter's notes. The objective record, scores for speed and errors, follow the personal account.

The final test was undertaken on Friday evening, August 7th. After a full week of hard mental work and a normal night's rest (11:45 P. M. till 7:00 A. M.) and a full day spent in reading experimental psychology, history of education and Dewey's *How We Think*, I began work at 11:00 P. M. Physically, I was in good condition for the test; that is, I was in usual health, without much sign of headache or eye-strain and tired enough to wish I might go to bed. Yet, I entered upon the test with some zest, determined to keep the work going as long as I could do so at all, and I suspected that this meant a rather long struggle, as it has not been my habit to drop a thing easily that I have determined to do.

I seated myself at my desk—where I had worked most of the afternoon and evening—and did not leave my place till I was no longer able to work. Beginning at 11:00 P. M., I worked continuously till after 3:07 A. M.—the last time recorded, and for some time later, but I was too worn out to record or to notice the exact time when I gave up the struggle.

As the work progressed I had a feeling that I was making good time and being fairly accurate. During the first hour I noticed little growth of fatigue. By the close of the second hour *bodily* weariness was weighing heavily, much more so than mental weariness, but I felt I could continue some time longer.

The feeling of interest in the experiment did not wane so long as I was able to get and hold products reasonably. As real interest waned during the third hour, I prodded myself mentally and took more interest in my intellectual condition than in the mere matter of fatigue. My growing inability to banish from memory previous partial products and to hold the new ones that I wanted, inability to speed up, greater and greater length of time necessarily spent in repeating partial products and sums, loss of memory so as to have to start problems over, etc., were all very prominent mental states.

There was no feeling of wishing it were over, so I might rest, but more of lethargy. The keen feeling of bodily discomfort slowly disappeared, but the consciousness of physical heaviness increased.

Sleepiness became an issue during the last half of the second and first part of the third hour. This state passed and did not return. Early in the third hour inability readily to leave a completed problem and begin another became more and more noticeable. I was conscious of this and tried to overcome the growing tendency to secure a rest period by merely repeating either the completed product or the time just recorded. As the sleepy stage passed away, I began to feel short of breath, and to breathe more and more heavily, and at times seemed unable to continue till I had taken one or two long deep breaths. These became more frequent, till at the end of the experiment about every fourth or fifth breath was of that sort. It was some twenty minutes after I quit work before I could breathe normally.

Near 2:30 I seemed to have about reached my limit. I became interested in a new study of my mental condition. I felt a little like two people—one trying to multiply and the other sitting by and looking on. The work proceeded slowly, laboriously and almost aimlessly. The mental activities seemed to be so little under voluntary control; my inability to stop doing or repeating one thing or even to remember at times the partial product I had just secured became so marked that I began to question the effect of the experiment on my sanity. At 2:35 I decided that if I could finish the problem I was then working, I would drop to a four-times-three or a three-times-three. I did finish it and after writing the result, recorded the time. I then lost all conscious grasp. A few minutes later my wife entered the room and found me, she said, aimlessly repeating the time I had shortly before recorded. Her smothered laugh attracted my attention, and I determined to show her that I could still solve four-times-four's. I did succeed in solving another problem in what proved to be sixteen minutes and thirty seconds. I was scarcely able to hold myself upright in my chair.

Feeling my inability to solve another four-times-four I thought to lighten the task, so turned to a three-times-three. I worked at the first one for some time. I tried to arouse myself by winding my watch, but did not succeed in getting even the first partial

product. My wife noted the time and aided me in getting to bed. Alone, I should have scarcely gotten to bed, unless something had happened to shock me. That might have served the purpose.

TABLE I.
Condensed Results for the Practice Period

Date	Digits in Multiplied.	Multiplier	Problems Solved in 60 min.	Total Wrong Figures in Answers	Time in Sec. Quickest	Slowest
July 21	2	2	46	14		
" 22	2	2	73	12		
" 23	3	2	29	9		
" 24	3	2	42	16		
" 26	3	3	16	7		
" 27	3	3	15	11		
" 28	3	3	19	10		
" 30	4	3	13	20	120	475
" 31	4	3	11	15	180	490
Aug. 1	4	3	13	9	220	425
July 29	4	4	7	2	300	800
Aug. 3	4	4	9	20	310	570
" 4	4	4	9	22	240	595
" 5	4	4	9	22	275	695

TABLE II.

Final Test. Aug. 7. Mental Multiplication of 4-place by 4-place Numbers. Time 11:00 P. M. to 3:07+ A. M.

No. of Problem	Time in Sec.	Wrong Figs. in Answers	No. of Problem	Time in Sec.	Wrong Figs. in Answers	No. of Problem	Time in Sec.	Wrong Figs. in Answers
1	315	0	11	395	1	21	785	4
2	255	1	12	445	2	22	1345	0
3	330	2	13	415	0	23	770	3
4	275	0	14	485	4	24	640	5
5	295	6	15	370	1	25	415	5
6	405	2	16	420	2	26	1465	1
7	390	1	17	370	0	27	800	1
8	565	1	18	390	3	28	900	3
9	310	0	19	320	4	29	∞	—
10	280	1	20	580	0			

Inspection of Table II shows in general a gradual rise in time per problem from the first to the eighth, a relatively steady period from the 11th to the 18th problem and a marked rise in the time

for the remaining problems. There appears to be no obvious correlation between the time and the accuracy scores.

CONCLUSIONS

From this single experiment it would, of course, be absurd to generalize concerning the course of mental work under extreme fatigue. However, the outcome suggests strongly that there exists a definite and relatively abruptly appearing point beyond which mental work becomes impossible. The experimenter feels that while possibly some tremendous reward or incentive might have enabled him to have continued for a brief time, the end of his capacity would have been postponed only for a few minutes at the most. So far as this experiment is concerned, in any event, when ability mentally to multiply a four-place by a four-place number had come to a stand-still as a result of extreme mental fatigue, ability mentally to multiply any number by any other number was also lost. In fact, in the judgment of the experimenter, though no tests were made upon this point, ability to do anything that could properly be termed mental work was lost as well.

Peter T. Sanford

AN EXPERIMENT ON THE INFLUENCE OF TRAINING ON MEMORY

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College, New Orleans.*

A review of the theoretical discussions of the subject of "transfer of training" leaves one with a well defined impression that habits are essentially specific but that, theoretically, a specific habit may be formed, the stimulus of which is a factor so common to immense groups of situations that in its practical effect it is a general habit. Among such general stimuli are found ideals, useful systems of attack on different sorts of problems, and any general concept which modifies our manner of dealing with concrete situations.

The experimenters, on the other hand, seem to have taken no direct account of these habits, general in their effect. They have either considered them *a priori* as necessarily by-products of the formation of a habit highly specific in its effect or as habits impossible to form, according to their personal bias on the question of "transfer of training." It is clear that any such habit as that of crossing a particular letter when seen on a printed page, tossing up one ball and preparing to catch another at sight of the descending ball or imaging the English equivalent when some foreign word is seen would be a highly specific habit the stimulus to which would be common to few situations. Some experimental investigation as to just how common to situations a factor may be and still serve as an adequate stimulus for the formation of a habit might help to clear the theoretical discussion on the subject of "transfer of training." If a habit could be formed with a very common factor as stimulus then we would have at command the mechanism for a process in all practical effects the equivalent of "transfer of training" with no theoretical complications to explain. On the other hand the failure of such experiments as crossing letters and teaching children to write neat arithmetic papers to show any effect of transfer may be explained by the failure of any such common stimulus habit to develop as a by-product during the formation of a habit involving a response to a unique stimulus.

The following is the account of an attempt to set up in a number of children a habit involving a stimulus which is common to very many situations where memory functions, and to test its efficacy in such situations.

A vocabulary, an amount of prose or poetry, the multiplication table or any such material to be memorized offers to the learner a more or less homogeneous mass of units which he must isolate in pairs or groups and attend to until each unit is firmly associated with at least one other unit in the mass. This isolation process is more definite in the matter of a vocabulary than in learning prose but, though the shifting of attention from group to group is more rapid in the case of the prose each word must be held in the focus of attention with another word at least once and usually several times before the prose is learned. An individual with a habit of reacting to any homogeneous mass of material with some such definite process of isolation of pairs or groups might conceivably memorize the mass more readily than one who had no such habit. Such a habit might, it seems, fairly be termed a "habit of attention" and the following means was devised as a possible method for forming a "habit of attention."

Twenty sets of slips seven and one eighth by five and five eighths inches in size were prepared. Each slip had printed on it thirty-two two-syllable English words. The words were arranged on the slip in irregular order and the twenty sets differed in that the arrangement of the words on the slips was unique for each of the twenty sets. Different words were also used in each set. Twenty sets of slips were similarly prepared using nonsense syllables instead of words. Below are specimens of both the word and the syllable slips.

sif	bos	doz	hiv	paj	kiz	
giq	lih	luk	qel	dup	jin	que
	jil	dek	xaq	zes	teq	
teh	zef	heq				
kul	goj	fiz	reh	zoz	sab	
qeh	zab	foy	yez	bok		
	money	portrait	account	credit		
balance	payment	hundred	counter			
against	contract	bargain	control			
outline	profit	coinage	balsam			
copy	unite	coquette	cordon			
currents	cornet	revise	printer			
correct	shifter	cutlet	something			
paying	express	curtain	wrapper			

The subjects to be trained in the "habit of attention" were presented once a day with one of these slips. For five minutes the subjects were asked to isolate the units (words or syllables) in pairs and attend to these pairs. The subjects were asked *not* to try to learn the units and never to use in combination two units which were adjacent in any direction. The latter was a precaution against the formation of mechanical systems of isolation. They were also told not to try to associate words or syllables which were alike or which had any reason for being associated. It was made as clear as possible that the only thing they were to do was to isolate these units and attend to them in pairs. They were told to do this as often as possible in the time allowed them and to use as many different combinations as they could. They were asked to make on a paper provided for the purpose a straight mark for each combination they attended to. This was mainly for the purpose of holding their attention to the work and as there was no possible check on their reliability the number of these marks was taken as a general rather than as an accurate index of the number of combinations made. At the end of five minutes the papers and slips were taken up. A record was kept of the number of marks each subject made each day. The twenty sets of words were used first and following that the twenty sets of nonsense syllables. Eight times (four while the words and four while the syllables were being used) the subjects were unexpectedly asked to write all the words or syllables they could think of after the slips had been collected. This work with the words and syllables constituted the training series.

It may be urged that even here the stimulus was not a "mass of homogeneous material" but a number of words and again a number of syllables. This objection could be urged against any material when the subject was not specifically told to regard the material only as a mass of homogeneous material. My subjects were children and I doubted their ability to follow such verbal instruction profitably. By using two different sorts of material during the training series and by stressing the emphasis on the isolation of the combination of units as the important factor in the procedure I attempted to shape the conditions of the experiment so that the stimulus to which they reacted should be in effect a "mass of homogeneous material." As a check on

my control of this factor I used yet another entirely different sort of material in the test series the description of which follows.

Before the training series began a test was given based on the old fashioned game of memory played at children's parties. Thirty-two ordinary objects picked up about the house were spread on a small table. Each subject was asked to stand for two minutes in front of the table memorizing the objects and then go to another room and write the names of as many of the objects as she could remember. This test was repeated with a new set of objects at the end of the series with words and again at the end of the series with syllables. It was like the training series in that it presented a homogeneous mass of thirty-two units to the subjects. It was unlike the training series in that the subjects were asked to learn these units while during the training series they were only asked to attend to the units in pairs. The following is a list of the objects used in one of the table tests.

Pink stationery box	Glove buttoner
Letter	Picture hanger
Bundle of wire	Paintbrush
File	Button hook
Box of matches	Perfume bottle
Red Cross adhesive plaster box	Sponge
Framed photograph	Lens of eyeglasses
Memorandum book	Hairpin
Eyeglass case	Bodkin
Prayer book	Small grey box
Spoon	Penknife
Candle	Brown box
Powder box	Ink bottle
Scissors	Pin
Candle stick	Drinking cup
Pen	Magazine

A second type of test was given which merely involved ordinary memorizing as it is done in the schools. The subjects were given slips of paper with paragraphs of prose printed on them and told to memorize the prose. They were allowed five minutes in which to do this and then the slips were taken from them and they were asked to write what they could of the prose. One such test was given before the training series began and another, with prose of approximately the same length and difficulty, was given after the training series was entirely over. Below are the two prose selections used.

I

ROBIN HOOD AND HIS MERRY MEN

Lend a courteous ear, all ye that be of gentle birth, while I tell you of a bold outlaw whose name was Robin Hood. The best archer was he that ever drew a bow in Merry England. In the famous town of Locksley hard by the great forest of Sherwood, he was born and nurtured, and there he dwelt until he had seen some fourteen summers. Of noble birth he was and should have been an earl; for his father was a Norman knight, Robert, Earl of Huntington, his mother a noble Saxon lady.

But in the wars between King Henry and his sons, Earl Robert took arms against the king; and it was so that when the king won the victory in the year of grace 1147, Earl Robert was taken captive and soon after beheaded as a traitor to his lord the king. Moreover the king proclaimed Robert, the Earl's only son "a wolf's head;" that is, an outlaw whom any man might slay without fear of the law, and gave his inheritance to his uncle, the proud bishop at St. Mary's, and his cousin, the high sheriff of Nottingham, for they had taken the king's side against his sons.

II

PEREDUR, THE SON OF EVRAWG

The next day Peredur went forth by the high road, along a mountain-bridge, and he saw a valley of a circular form, the confines of which were rocky and wooded. And the flat part of the valley was in meadows, and there were fields betwixt the meadows and the wood. And in the bosom of the wood he saw large black houses of uncouth workmanship. And he dismounted, and led his horse towards the wood. And a little way within the wood he saw a rocky ledge, along which the road lay. And upon the ledge was a lion bound by a chain, and sleeping. And beneath the lion he saw a deep pit of immense size, full of the bones of men and animals. And Peredur drew his sword and struck the lion, so that he fell into the mouth of the pit and hung there by the chain; and with a second blow he struck the chain and broke it, and the lion fell into the pit; and Peredur led his horse over the rocky ledge, until he came into the valley. And in the center of the valley he saw a fair castle, and he went towards it.

The kind co-operation of President B. V. B. Dixon and Miss Sue Gillean, Instructor in the Newcomb High School, made it possible for me to use as subjects in this experiment two sections of Class B in the Newcomb High School. They were girls from eleven to thirteen years old. It so happens that at Miss Gillean's request I had previously tested these children for imagery type and the sections had been formed on that basis making one section of ten auditory-motor children and one of eight visual children. This was done to facilitate the emphasis on imagery type in teaching. When I gave my preliminary table test to the two sections I found that the visual section did better at it than the auditory motor section, which seemed natural, and on that account I chose the auditory motor section for the section to give the training series to and reserved the visual section as a check section which should take only the test series. The ten auditory motor children were fairly regular in their attendance,—only one dropping out of school toward the last. Out of the visual section, however, there were only four who took both the first and the last test series. The first test was given November 18, 1914, and the last test May 18, 1915. The results for both the training series and the test series follow.

TABLE I.

Number of marks indicating combinations made during five minutes training with words and syllables.

Subject	WORDS							
	Nov. 25	Nov. 30	Dec. 1	Dec. 2	Dec. 3	Dec. 4	Dec. 7	Dec. 8
1	193	303	334	393	382	308	243	201
2	68	absent	85	160	208	230	270	228
3	71	128	165	328	305	300	379	419
4	105	119	183	202	229	240	264	284
5	83	110	102	134	172	192	200	185
6	67	128	218	185	251	282	298	276
7	176	216	165	324	332	264	243	293
8	76	119	136	231	266	255	239	256
9	absent	111	209	255	248	244	195	228
10	153	200	143	186	312	331	295	285

TABLE I. (continued)

Subject	WORDS							
	Dec. 9	Dec. 10	Dec. 11	Feb. 22	Feb. 24	Feb. 25	March 1	March 3
1	absent	185	219	240	240	187	184	232
2	absent	absent	198	221	194	165	181	173
3	380	313	297	497	163	301	215	250
4	226	210	272	295	167	258	244	214
5	152	192	92	239	203	155	absent	158
6	226	214	233	333	146	335	374	215
7	208	217	258	259	227	173	222	241
8	221	240	257	293	248	179	215	224
9	237	279	278	236	203	207	261	261
10	168	199	241	119	175	181	166	absent

TABLE I. (continued)

Subject	WORDS				Number of words recalled during unexpected tests immediately after five minute training			
	Mar. 5	Mar. 8	Mar. 10	Mar. 11	Nov. 25	Dec. 7	Mar. 1	Mar. 11
1	223	242	194	210	6	8	8	11
2	absent	185	158	171	14	12	10	11
3	205	241	486	242	8	5	11	10
4	269	261	252	239	10	10	11	9
5	263	162	185	223	12	8	absent	6
6	340	327	284	285	15	17	17	15
7	251	269	137	233	12	12	11	14
8	220	254	174	206	9	5	8	7
9	absent	176	231	203	absent	8	12	7
10	266	180	185	242	9	7	4	9

TABLE I. (continued)

Subject	SYLLABLES							
	Mar. 17	Mar. 18	Mar. 22	Mar. 24	Mar. 25	Mar. 25	Mar. 29	Mar. 31
1	absent	145	132	204	186	284	168	
2	139	218	224	absent	absent	absent	absent	
3	371	295	358	213	309	357	246	
4	151	276	215	238	185	219	212	
5	105	165	119	116	185	150	131	
6	149	225	351	146	151	171	135	
7	59	178	absent	154	139	182	absent	
8	168	162	57	76	73	133	103	
9	203	128	229	185	180	306	106	
10	128	174	141	148	162	187	240	

TABLE I. (*Continued*)

SYLLABLES								
Subject	April 1	April 5	April 8	April 12	April 14	April 15	April 19	April 21
1	215	251	150	265	181	168	95	155
2	absent	absent	absent	absent	absent	absent	absent	absent
3	absent	290	259	329	276	185	219	246
4	201	234	208	247	208	195	227	284
5	164	absent	114	141	158	181	183	168
6	220	297	269	239	273	247	235	145
7	192	160	150	204	140	182	234	175
8	131	120	72	116	101	113	80	131
9	290	216	204	209	138	283	105	115
10	334	absent	304	296	259	absent	absent	absent

TABLE I. (*continued*)

SYLLABLES									Number of syllables recalled during unexpected tests immediately after five minutes training	
Subject	April 22	April 26	April 28	April 29	May 3	March 18	April 1	April 15	May 3	
1	78	126	98	99	211	1	8	1	10	
2	absent	absent	absent	absent	absent	1	absent	absent	absent	
3	187	265	379	207	245	3	absent	4	4	
4	236	256	300	218	256	2	9	7	8	
5	106	226	229	183	198	5	6	4	5	
6	136	222	135	328	419	9	17	13	10	
7	195	193	301	196	absent	5	6	7	absent	
8	102	108	116	89	115	1	4	1	6	
9	97	208	187	125	221	1	6	0	7	
10	absent	absent	absent	297	376	1	1	absent	3	

TABLE II.

*Table Tests**Percentage of objects recalled*

Subject	Test			Subject	Test		
	1	2	3		1	2	3
1	53%	75%	87%	1	53%	69%	56%
2	34	59	absent	2	53	65	75
3	47	56	69	3	56	78	50
4	50	75	78	4	31	69	97
5	44	78	78	Average	48.25%	70.25%	69.5%
6	44	72	97				
7	53	72	72				
8	44	50	47				
9	47	59	69				
10	47	81	87				
Average	46.3%	67.7%	76%				

TABLE III.

*Prose Tests**Percentage of correct words recalled in correct order*

Subject	Test 1	2	Subject	Test 1	2
1	26%	32%	1	63%	63%
2	absent	absent	2	10	11
3	39	32	3	25	27
4	56	50	4	34	7
5	39	36	Average	33%	27%
6	41	75			
7	50	35			
8	33	28			
9	50	50			
10	6	8			
Average	37.77%	38.44%			

Both sections show a marked improvement in the record for the second table test over that for the first. But while the untrained section did slightly worse on the occasion of the last table test the trained section again made considerable improvement. There is also a distinct drop in the results of the second prose test from those of the first in the case of the untrained section. There is a slight corresponding rise in the records of the trained subjects. In view of the wide disparity between the type of work in the prose test and that in the training series this seems rather significant.

The subjects were so few and the time available with them so comparatively short that I hesitate to draw conclusions on the basis of these results. But they seem to indicate that at least there still remains the possibility of forming by direct means a habit which may be genuinely general in its effect. To my own infinite astonishment I seemed to have given these children a "habit of attention" which was useful to them in memorizing. At any rate from the evidence now at hand further experiments along this line need not necessarily be unprofitable.

The significance that this might have for the problem of transfer of training has already been noted. But the problem of "formal discipline" would not, I believe, be implicated because, to my mind, the rise of any habit as a response to a stimulus common to many situations in connection with any study would be accidental and unpredictable since the study is directly concerned only with the formation of habits with unique stimuli. In this event the possibility of forming a habit with a stimulus generally common would be no more directly related to the study of Latin than to the study of cooking.

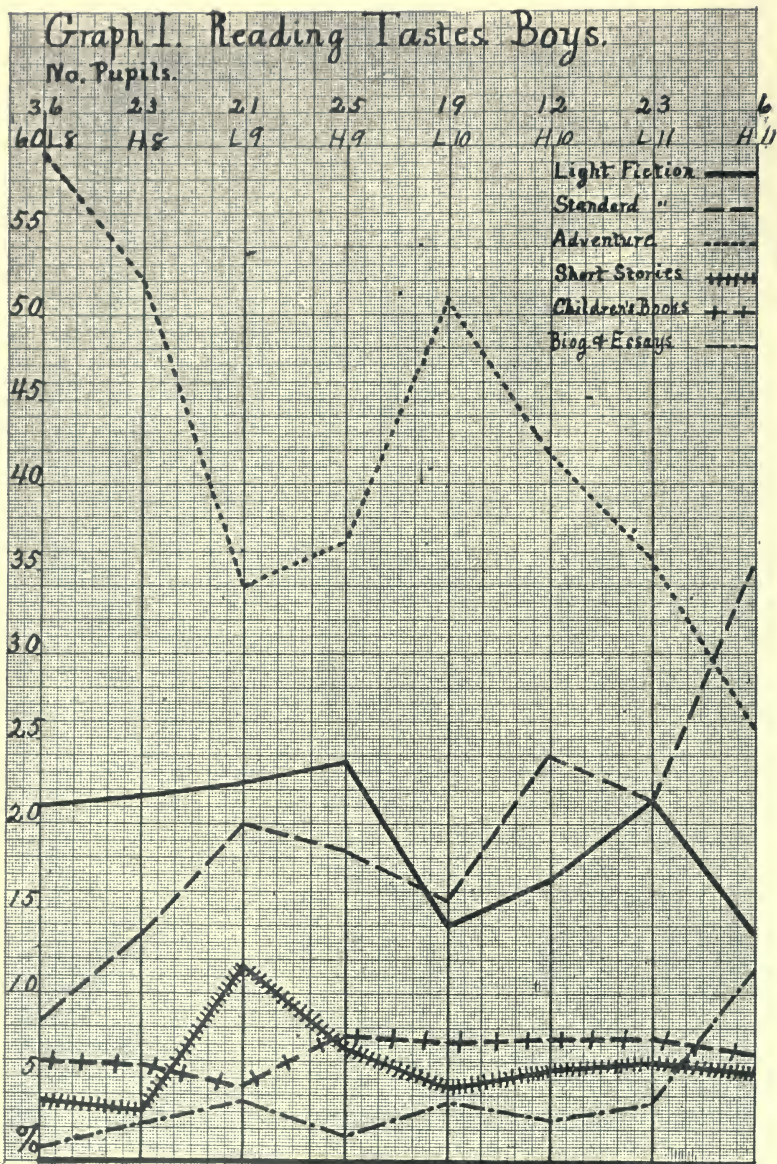
COMMUNICATIONS AND DISCUSSIONS

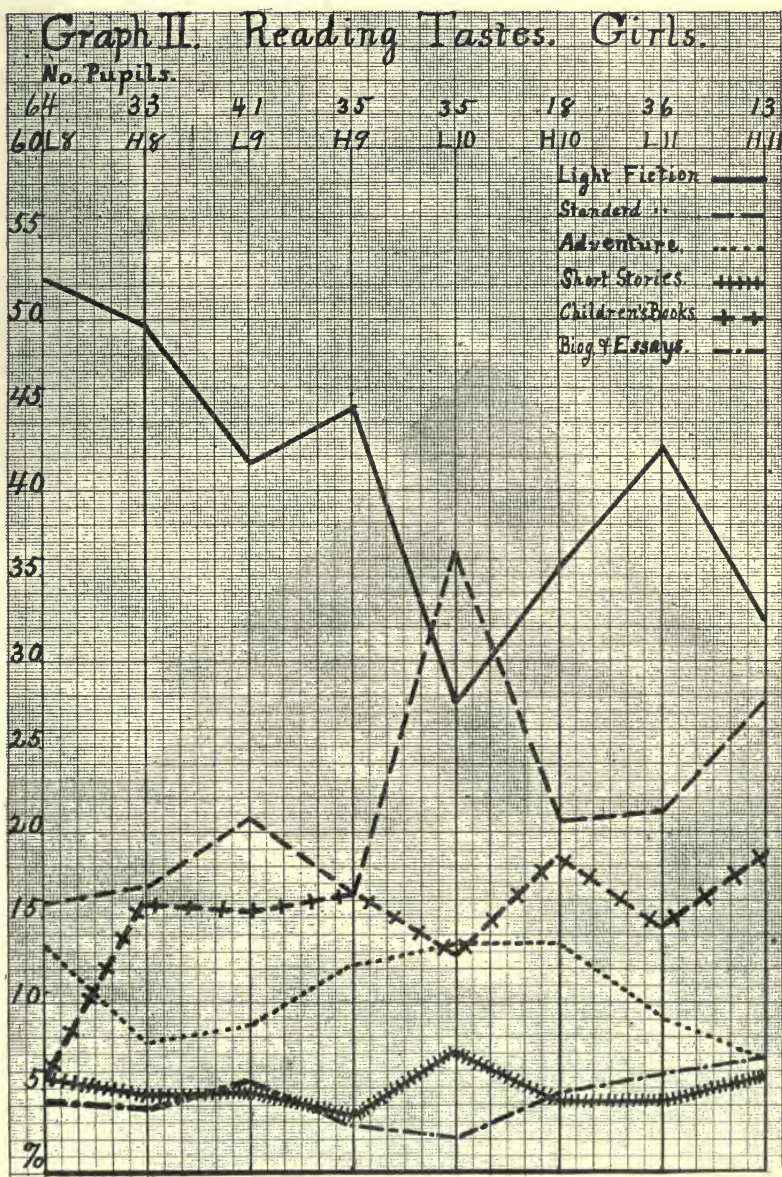
THE READING INTERESTS OF HIGH SCHOOL PUPILS

Contributions from the University of Texas Educational Laboratory No. 2

This paper presents the results of an attempt to ascertain what reading is done by high school pupils. In order to arrive at a basis for the investigation a preliminary list was first drawn up, including authors and works which it was thought young people would be likely to read. This list was submitted to a class of college freshmen with the request that they check all the works that they had read and indicate any other reading not found on the list. From these results a final list was prepared containing all the authors and all the separate works mentioned by as much as twenty per cent. of the students. This list contained the names of one hundred and ten authors, and seventy-nine of their books were listed specifically by title. Below the name of each author a space was left for the inclusion of other works than those mentioned, and at the end of the paper there were thirty-four blank spaces for an account of additional reading. To the left of the column of authors' names were three blank columns, in which the student was requested to indicate for each book whether the reading was done before the entrance to high school, or during the high school course, and whether the reading was required or not. To the right of the authors' names were six columns to indicate the degree of liking; that is, whether it was a favorite book, whether the reader liked it fairly well, disliked it, re-read it, would like to re-read it, or whether it was only partially read. In another column, the students were asked to indicate their reasons for liking or disliking the books.

These papers were distributed among the pupils of the Austin High School with the instructions that they were to be filled out and returned after an interval of two days. About sixty-five per cent. of those distributed were returned. Some of them were filled out fully, others only in part; a few had to be rejected on account of insufficient date. A total of four hundred and forty replies were finally included in the report, representing one hundred and sixty-five boys, and two hundred and seventy-five girls. The results for boys and girls were tabulated separately, and separate tabulations were made





for each half grade. The first study made deals with the amount and kind of voluntary reading which the pupils do during the high school period. Outside of required reading, very little poetry is read. Almost the only poets mentioned as having been voluntarily read were James Whitcomb Riley, and Eugene Field. For this reason poetry was omitted from the curves plotted to show the results of this study.

Reading was classified under nine heads: History, science, fairy stories, children's books, biography and essays, standard fiction, books of adventure, light fiction, and miscellaneous short stories. Three of these classes (history, science, and fairy stories) were so small that they are omitted from the graphs. On account of these omissions the total of the per cents for any graph shown on the graphs is somewhat less than one hundred.

Inspection of the graphs warrants the following conclusions:

1. With the girls, light fiction forms the largest part of voluntary reading. The general tendency is for this to decrease during the high school period, but a decided fall in the low tenth grade is followed by a rise in the high tenth and low eleventh.

2. With the boys books of adventure take the high place occupied by light fiction with the girls. On the other hand, books of adventure with the girls drop to practically the same position as that held by light fiction with the boys. The two classes of reading occupy reversed positions with the two sexes. With the boys the general tendency is for the popularity of books of adventure to decline in the higher grades; with the girls this tendency is less marked.

3. The interest in standard fiction increases with both boys and girls as we go up through the grades.

4. The short story does not hold as high a place as might be expected with either boys or girls. Its position remains fairly constant throughout the grades.

5. With the boys children's books take about equal rank with short stories. With the girls they are much more popular. Their popularity with the girls increases as we advance in the grades, while with the boys it remains about stationary.

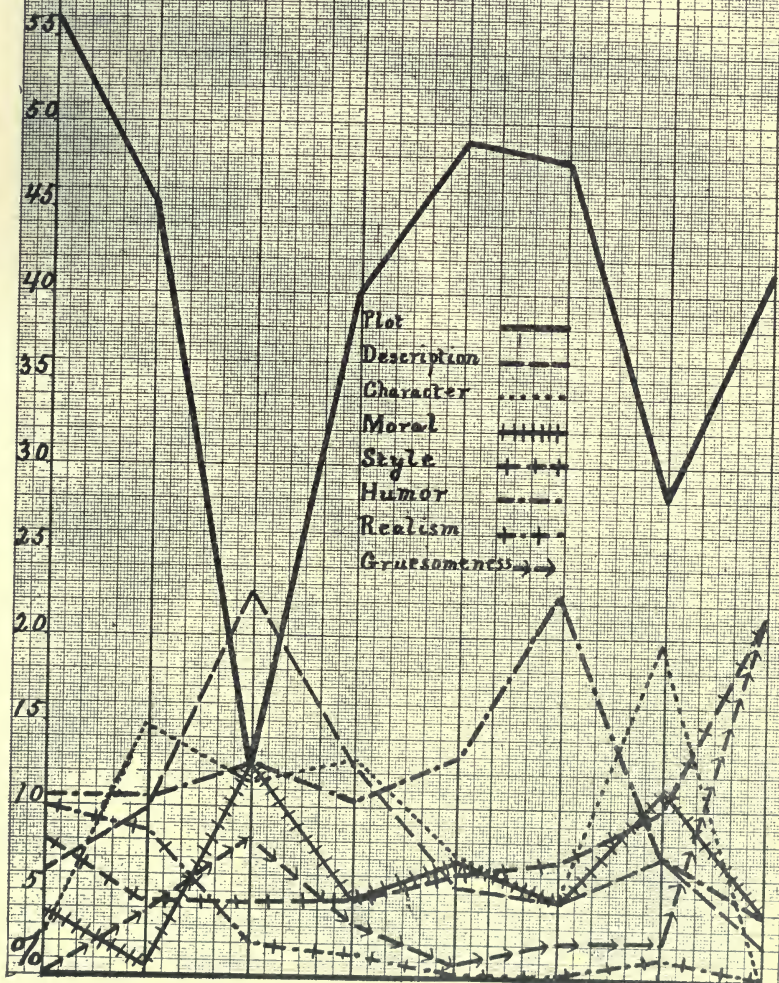
6. Biography and essays show a slight increase in popularity with both boys and girls, but they do not take a high rank at any time.

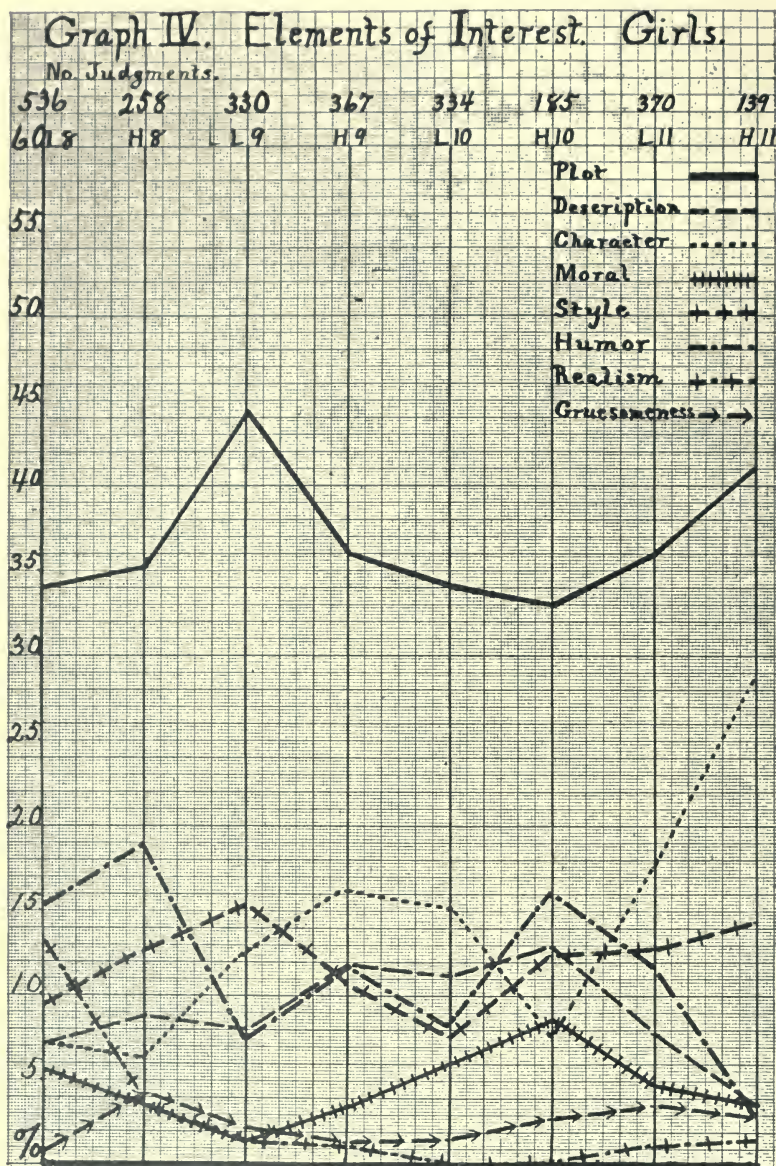
A further study was made of the material from the point of view of the reasons given by the pupils for their likes and dislikes. Practically all reasons for liking books were classified under eleven elements

Graph III. Elements of Interest. Boys.

No. Judgments.

161	181	97	211	259	44	330	51
60L8	H8	L9	H9	L10	H10	L11	H11





of interest: plot, character, description, moral, fancy, pathos, humor, historical interest, realism, style, and gruesomeness. Graphs three and four indicate the relative values of the more important of these elements of interest. Fancy, pathos and historical interest have been omitted from the graphs because of their infrequent occurrence.

From these graphs it will be seen that interest in plot takes the first place in all grades with the girls, and in all but one with the boys. Interest in character is irregular with both boys and girls; while that in description is fairly constant for girls, though decidedly irregular for boys. Interest in the moral element never rises very high among the girls. It begins in the low eighth at five and six-tenths per cent., drops steadily to the low ninth, rises gradually to the high tenth, and falls again. The average with the boys is higher, though in the high eighth this element of interest drops lower than in any grade among the girls. Humor ranks high with both boys and girls, and style is fairly high with the girls in every grade, but moderately low for the boys, except in the high eleventh, where it rises to a higher point than is reached in any grade by the girls. With both boys and girls interest in realism begins comparatively high, but drops constantly until the end of the high school. Interest in the gruesome is low with girls, and rises high with boys only in the low ninth and high eleventh grades.

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THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

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VOLUME VII

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NUMBER 1

EDITORIAL

The past year has been characterized by a steady and healthy increase in the amount of educational research produced in this country. Several new tests have been devised which promise to be of distinct value in mental diagnosis. Noteworthy among these is T. L. Kelley's Constructive Ability Test, an account of which appears in the present issue of this JOURNAL. In the standardization and further application of old tests good work has been done by Miss Hall of Albany, by Pyle of Missouri, by Pintner of Ohio, with the Knox Cube Test, by Wallin of St. Louis, with the form board, and by Mrs. Wooley of Cincinnati. The latter is rendering a particular service in establishing norms for adolescents who leave school to go to work, and is thus furnishing a basis for comparison between these young people and those who go on to high school.

In the field of tests of intelligence the Binet scale is undergoing extensive revision and reorganization on the basis of the elaborate

studies of Terman of Leland Stanford. The mass of data collected from the examination of over two thousand children with the old Binet tests and several supplementary ones has furnished material for a careful evaluation and placement of the individual tests, and has resulted in an entire re-arrangement of the upper portion of the scale. No user of the Binet scale can afford to ignore Terman's work, a detailed account of which is promised in a monograph to be published some time next summer.

The rapidity with which the Yerkes point scale is growing in favor has aroused some protest from old line Binet testers. It must be admitted that the individual tests of the point scale present nothing new, as they are taken almost bodily from the Binet list. The chief advantages of the point scale are its flexibility, allowing the introduction of new tests without destroying the validity of the old ones, and the substitution of norms derived from the study of special groups for the concept of mental age. In some respects the point scale would seem to offer a finer and more accurate measure of achievement than the Binet scale. What is urgently needed is a more careful qualitative study of individual tests in order to determine their significance and point value in relation to other tests.

In no field of educational research has there been greater activity during the past year than in devising scales for the measurement of attainments in school subjects, and in the application of these scales and standards of measurement to school children. This activity has been fostered by the spread of the school survey idea and by the demand on the part of school officials and others for more accurate knowledge of the accomplishment of pupils in school subjects. Among the contributions worthy of special mention are Freeman's and Gray's studies in handwriting, Childs' application of the Thorndike drawing scale, Rugg's scale for freehand lettering, Thorndike's studies in reading and the Kansas reading tests devised by F. J. Kelly, Ayres' spelling scale and Sackett's application of the Buckingham spelling scale to an entire school system, the Indiana coöperative studies in arithmetic, involving the use of the Courtis tests, and Starch's studies in reading, writing, spelling, and grammar. It is remarkable that all these studies are limited to elementary school subjects, and that, with the exception of a preliminary investigation in algebra by Walter S. Monroe, nothing has been attempted in the high school field. In view of the unrest in secondary education scientific studies of the attainments of high school pupils are greatly needed.

J. C. B.

NOTES AND NEWS

The Bureau of Educational Measurements and Standards of the Emporia, Kansas, State Normal School is rendering excellent service by interesting superintendents and teachers in the use of educational tests and scales. Directions have been drawn up for the use of the Thorndike, Ayres, and Freeman handwriting scales, the Hillegas and the Ballou composition scales, the Courtis arithmetic tests, the Buckingham and the Ayres spelling scales, and other scales for the evaluation of school work. The Bureau has devised record sheets for tabulating the scores obtained from a class and has thus materially facilitated the use of the tests by school people. The Kansas Silent Reading Test, devised by Dr. F. J. Kelly, an account of which will appear in the February number of this JOURNAL, is meeting with great favor, and is being widely used by teachers and superintendents in Kansas and adjacent states. In Iowa, for example, it is proposed to standardize the work of school grades in reading by the general use of these tests, and an order has been given for 12,000 copies to be distributed to Iowa schools under the direction of the Dean of the School of Education at the University of Iowa.

Professor Lewis M. Terman of Stanford University has recently issued a "Condensed Guide for the Use of the Stanford Revision and Extension of the Binet-Simon Measuring Scale of Intelligence." This guide is based on tests of more than 2050 children and 300 adults. A complete guide is promised by June, 1916. In addition to the rearrangement of some of the tests, the most striking changes are a series of tests for the fourteenth year, the omission of tests for the fifteenth year, and two series of tests for adults, one for the average adult estimated at age sixteen, and the other for the superior adult at age eighteen. The guide presents detailed directions for giving the tests, tabulating the results, calculating mental age, determining the intelligence quotient, and interpreting the results. In the Stanford revision each year contains six tests, one for each two months up to the tenth year. After that it will be noted that there are tests for every other year, eight for the twelfth year, with a value of three months each; six for the fourteenth year, with a value of four months each; and six for each of the years sixteen and eighteen, with a value

of five and six months each respectively. The further use of this revision should furnish interesting data on mental testing.

Dr. David Spence Hill, Director of the Division of Educational Research, New Orleans Public Schools, has recently prepared for distribution to teachers an age-grade sheet, showing the status of each grade in each school for the entire city, with city averages and average deviation. The children of each grade are grouped in five divisions; those at or below age making usual or rapid progress, those at or below age making slow progress, those over age due to late entrance or lost time, those over age due to slow progress, and those repeating. It is perhaps the most elaborate statistical exhibit of the age-grade status of pupils that has ever been put in the hands of the teaching forces of a public school system.

The ninth annual convention of the National Society for the Promotion of Industrial Education will be held at Minneapolis, January 20 to 22. A feature of the meeting will be the report on the Minneapolis Industrial Survey, which has been participated in by the officials of the public school system, of the Dunwoody Institute, and by the Survey Committee of the Society. The survey has taken two main lines: a study of the schools with reference to the preparation afforded for industrial productiveness; and a study of the industries of the city with reference to the opportunities for boys and girls to obtain employment, and for the kind of training which may be afforded them.

Professor Hans Gross, whose death at the age of 68 has just been reported, was born December 26, 1847, in Graz, Austria, and was at the time of his death, professor in the university at that place. Gross was a man of stupendous erudition, the author of numerous works bearing upon criminal law and criminology, and the editor, since 1898, of the important *Archiv für Kriminal-Anthropologie und Kriminalistik* (usually cited as *H. Gross' Archiv*). In his great work *Criminal Psychology* (English translation, 1911) Gross has given us the most authoritative and comprehensive exposition of the mental states of criminals and likewise of judges, juries, experts and witnesses. His labors have touched psychological and educational problems at various points, so that his death is a loss in these fields as well as in the field of jurisprudence.

Dr. L. W. Rapeer, professor of education at the Pennsylvania State College, will give a course of lectures for one week at the opening of the summer session of the University of Kansas. The subject of the course will be "The Administration of Educational Hygiene."—*School and Society*.

It is stated in *Midland Schools* that through the coöperation of fifty of the leading business and professional men of Stevens Point, Wis., President John F. Sims, of the Stevens Point State Normal School, has secured Dr. Montessori to give her teacher training course under the auspices of the normal school. Dr. Montessori and her assistants will come from San Francisco in time to open the course on Monday, January 24, 1916. The course will continue for a term of six months, and, in addition to the lectures given by Dr. Montessori, lectures will be given by her assistants, and a demonstration school will be in operation for the purposes of study and observation under the personal supervision of Dr. Montessori. The fact that the training course is to be given under the auspices of the State Normal School makes it possible to place the tuition fee at about one-third of the regular rate. Principal F. S. Hyer, of the training school, is chairman of the enrollment committee.—*School and Society*.

The new research department of the Whittier California State School, under the direction of Mr. J. Harold Williams, is undertaking to apply the results of modern psychological studies and of mental testing to the education of delinquent boys. As a result of the application of the Binet tests last year, it became evident that fully twenty-five per cent. of the boys in the school were mentally so retarded that they could not pursue academic work profitably. The other boys will be classified on the basis of mentality tests, and their instruction will be carried on in groups determined by intelligence levels and trade aptitudes. Mr. Williams will be assisted in the conduct of the research department by Mr. Karl Cowdery, representing the Eugenics Record Office, who will carry on research among the families of the boys of this school.

Professor C. E. Benson, from the Kearney Normal School, Nebraska, goes to the State Normal School at Cape Girardeau, Missouri, to take charge of the department of education.—*School and Society*.

CURRENT PERIODICALS

EDUCATIONAL ADMINISTRATION AND SUPERVISION. Vol. I, No. 2, February, 1915. DON C. BLISS. *School Measurements and School Administration*. 79-88. Presents an account of the improvement in school work from September to May in handwriting, spelling, and arithmetic in grades, five, six, and seven, as measured by standard scales.

S. A. COURTIS. *Educational Diagnosis*. 89-116. The author uses the results obtained from the application of his standard tests to show how groundless are the fears of those who assert that the tendency of educational measurements is to reduce educational effort to a dead level of uniformity. On the contrary, the application of such measures serves to bring out in clear relief the individuality of the child and the particular treatment needed for his fullest development. Nothing makes for greater individualization in instruction than the exact determination of the status of the pupil in each school subject and in each phase of that subject. The author believes that by the use of standard tests, the efficiency of our teachers will be doubled in ten years.

HAROLD ORDWAY RUGG. *Teachers' Marks and Marking Systems*. 117-142. An excellent summary of the recent investigations of the distribution and reliability of teachers' marks, and their significance for the school administrator. There is a bibliography of thirty-nine numbers.

No. 3. March, 1915. ELLEN M. GREANY. *A Study of the Vocational Guidance of Grammar School Pupils*. 173-194. The article presents the results of an investigation in four Massachusetts city schools to determine how clear an idea eighth grade elementary school pupils have of a vocation, to find how this vocational vision has been acquired, and to discover the effect of a course of systematic expository instruction in vocational and educational opportunities. The instruction consisted of nine lessons on opportunities for boys and girls. Parallel groups of uninstructed children were selected for observation, and a year later it was found that a considerably higher percentage of the instructed than of the uninstructed group were engaged in work that would help fit them for the work they eventually intended to pursue; while a very much smaller percentage of the instructed were found in "blind alley" occupations.

CHARLES L. HARLAN. *Size of Class as a Factor in School Room Efficiency*. 195-214. Data was secured on this point by a study of promotion rate, percentage of withdrawals from the class, scores in arithmetic made in the Courtis test, percentage of class not giving attention during recitation, percentage of class not participating in work of recitation, time spent in performing the various routine ac-

tivities of the school room, and percentage of time wasted by the class during study period. The author concluded that the class of medium size (23 pupils) seem too small for the most economical administration of our schools. The optimum size of the class seems to be from thirty to forty pupils.

No. 4. April, 1915. ALFRED L. HALL-QUEST. *Present Tendencies in Supervised Study*. 239-256. The author reports the results of a postal card questionnaire sent 969 high school principals in every state of the Union. Replies were received from 532 schools. Of these 87 per cent. claim that they have supervised study, chiefly in the assembly hall, but in the methods of securing this supervision, there is the widest variation. A somewhat detailed account is given of the experiments in supervised study that have been carried on in Joliet, Ill., and Bloomington, Ind.

No. 5. May, 1915. EDWARD C. ELLIOTT. *How shall the Merit of Teachers be Tested and Recorded?* 291-299. The author discusses the work that has been done in recent years in measuring the merit of teachers, reaffirms his faith in the desirability and practicability of such objective measures of efficiency, and calls for further co-operative experimental work to determine the reliability of methods of measurement and their usefulness for school officers.

EDWARD L. THORNDIKE. *Means of Measuring School Achievements in Handwriting*. 300-305. Assuming the use of either the Thorndike or the Ayres' scale, the author discusses the question of how many samples of handwriting must be measured to get a valid result for a school system. Suggestions are made for sampling schools and grades in a system, for sampling pupils within each grade, and for sampling papers in relation to judges. Directions are also given for the conduct of tests in handwriting.

EDWARD L. THORNDIKE. *Means of Measuring School Achievement in Spelling*. 306-312. Selections of words are made from Buckingham's spelling lists, and records are given for imaginary grades, schools, and school systems.

ERNEST C. WITHAM. *All the Elements of Handwriting Measured*. 313-324. The author considers that all the elements of handwriting are embraced under the rubrics of speed, legibility, and form and beauty. The author takes as his index of legibility the speed or amount of time required to write a given passage divided by the number of seconds it takes the pupil to read what he himself has written. Form and beauty may be measured by any of the standard scales, but the author prefers a scale for each grade constructed by the teachers themselves. The results of several measurements are recorded and from these it would seem that the home-made scale suits the author's purpose better.

No. 7. September, 1915. HENRY BUELLESFIELD. *Causes of Failure Among Teachers*. 439-452. The author reports the results of a questionnaire sent to 300 schools on the subject of the causes of failure. From these 140 replies were received. The first interesting

conclusion is that the per cent. of failures varies inversely with the number of teachers employed. In systems employing from nine to nineteen teachers, the percentage of failure is eleven times that in systems employing from 109 to 159 teachers. This seems to be due to the more careful selection of teachers in the larger schools. There are tables showing the distribution of failures in elementary and high schools according to sex and the number of teachers employed, the subject taught, and the amount of previous experience. By far the most frequent cause of failure is given as weakness in discipline. Unfortunately it is difficult to distinguish between this and other important causes of failure, such as lack of judgment, lack of sympathy, too nervous, could not control temper, etc. It is doubtful whether the mere tabulation of the judgment of supervisors will avail us much in understanding the causes of failure in teaching. A more detailed and intimate analysis of specific situations instead of the rough and ready judgments of superintendents is much to be desired.

No. 8. October, 1915. J. C. BROWN AND J. H. MINNICK. *A Study of the Preferences of Secondary School Pupils for the Various Subjects and of the Ranking of the Various Subjects on the Basis of Utility, as Judged by the Pupils.* 527-545. The data on which this article is based were derived from the Horace Mann School for Boys, and the Horace Mann School for Girls. The ranking of subjects by boys is chemistry, algebra, geometry, manual training, English, etc., and as ranked by girls, the first five choices are, English, history, arithmetic, trigonometry, and geometry. Interesting information is also obtained on what subjects were considered the most useful and the most useless, and on the subjects that they were then studying that they would most like to drop.

No. 9. November, 1915. J. L. MANAHAN. *Grading and Promotion of High School Pupils.* 577-590. A study of the distribution of the marks given to a class of 627 pupils of the Somerville, Massachusetts, high school during the four years of the course, and the distribution of marks in the separate departments, as mathematics, English, etc. Mathematics shows by far the highest percentage of failures; and the figures raise the question whether the teaching is satisfactory, or the course is properly suited to the needs of the pupils.

J. C. BROWN AND J. H. MINNICK. *A Study of the Preferences of Secondary School Pupils for the Various Subjects, and their Reasons for the Preferences.* 599-610. This paper is continuation of a study previously reported, and extends the investigation to 1600 pupils in the high schools of Decatur, Illinois, Dubuque, Iowa, and Hackensack, New Jersey. Among the subjects ranked relatively high by pupils are the commercial subjects, English, and mathematics; while the languages and history are ranked relatively low. Boys manifest a greater interest than girls in book keeping, mathematics, chemistry, and physics; while the girls show a greater interest in stenography, typewriting, English, and foreign languages.

No. 10. December, 1915. CARTER ALEXANDER. *A Laboratory Exercise in School Administration*. 646-654. The following problem was presented to a group of five students: How many and how varied standards existed for the assignment of grades in a local high school in the year 1913-14; what common standards could be worked out from the available data and urged for the acceptance of the school as a whole; and what practical suggestions could be made for the application of these standards by the several teachers? A study of the grades given shows that some teachers are more severe in grading boys and girls and vice versa; that the teachers vary greatly in the percentage of failures; and that the majority of teachers grade closely enough about a common scale to warrant taking this as a standard for the whole school. Suggestions are made for keeping this standard before the attention of the teachers.

ANNA EICHHORN. *Cheating in High School*. 655-662. The article reports the results of a questionnaire submitted to 1000 students in the high school of Decatur, Illinois. The answers to each of the ten questions are summarized and discussed. The indirect evidence as to the amount of cheating in the high school and the attitude of the pupils towards it is somewhat disquieting. Both estimates and confessions place the percentage of cheating at about 40, but the answers to some of the questions show that much can be done if the fundamental principles underlying the honor system are brought clearly before the minds of the pupils in debates, class discussions, literary societies, and in the high school paper.

E. E. LEWIS. *The Present Standard of Handwriting in Iowa Normal Training High Schools*. 663-671. The handwriting of 1760 third and fourth year students was rated by six judges on the basis of the Ayres Scale. The author finds that the maximum variation between the judgments of the six judges will not be over 10 points, or one step, in about six out of ten cases. As compared with the ordinary percentile method of rating handwriting the use of the scale reduces the variation by almost one-half. There was no apparent correlation between speed and quality.

PUBLICATIONS RECEIVED

KATHARINE ANTHONY. *Feminism in Germany and Scandinavia*. New York: Henry Holt & Company, 1915. Pp. vi, 260. \$1.25.

This is a clear and readable account of the woman's movement in Germany and Scandinavian countries. The first chapter gives a good sketch of the unity of thinking which prevails amongst the women of northern Europe. This is followed by chapters on schools and the woman, on dress reform, on the protection of motherhood and maternity insurance, on the status of the illegitimate child, and on the fundamental philosophy of German feminists. The author shows how intensely interested in the schools the new woman is, and what changes have been brought about in the education of girls. The book contains a good working bibliography.

ADOLF A. BERLE. *Teaching in the Home*. New York: Moffat, Yard and Company, 1915. Pp. xxii, 354. \$1.25.

The sub-title of this book is "A Handbook for Intensive Fertilization of the Child Mind for Instructors of Young Children." In his introductory "Letter to Teaching Parents," the author says that the book has grown out of the requests for guidance and information coming from parents who had read his previous book "School in the Home." The author believes that education should deal with negotiable knowledge. While it is true that much of the knowledge which the school inculcates is non-negotiable, the author begs his readers not to fight the school on this account but rather to help it, and if he could induce intelligent fathers and mothers to take the kind of interest in schools which he recommends, it would be the most powerful means for the improvement of educational facilities that could be imagined. The book is written in an easy conversational style, and has chapters on English, grammar, foreign languages, geography, history, physiology, botany, zoölogy, geology, and geometry. In the final chapter the author makes some excellent suggestions in regard to books that parents should have in their libraries.

FOSTER PARTRIDGE BOSWELL. *The Aims and Defects of College Education*. Hobart College Series Number 1. New York: G. P. Putnam's Sons, 1915. Pp. vii, 78. 80c.

The author endeavored to ascertain the opinions of prominent Americans on the two following questions: "What traits of character and mind should a college aim to develop in its students to make them useful and efficient in modern life?" and "In what ways

does the present college education fail in giving students training it is able to give?" The first part of the book is made up entirely of quotations from the replies. In part two, the author sums up the results and implications of these views. The three most important recommendations, according to the author, are that the college should impart to its students a deeper sense of the duty of public service; that each college should organize a committee on vocational guidance to aid its students in making wise choices of future occupations; and that members of the faculty should make a better use of their opportunities for moulding and determining undergraduate tradition.

HARRIETTE BROWER. *Piano Mastery. Talks with Master Pianists and Teachers.* New York: Frederick A. Stokes Company, 1915. Pp. x, 299. \$1.50.

This is a valuable series of interviews with many of the most eminent piano teachers and virtuosi on important points in piano teaching and piano technique. Among the artists represented are Paderewski, Schelling, Tina Lerner, Goodson, Hambourg, Bauer, Busoni, Careno, Lambert, Zeisler, Schnitzer, Gabrilowitsch, von Buelow, William Sherwood, and Dr. William Mason. These interviews are not of the ordinary superficial newspaper type but drive straight at the difficulties which the artists have encountered and the means taken to overcome these difficulties. It is a valuable book for anyone who is interested in the piano.

MARY WHITON CALKINS. *The Self in Scientific Psychology.* Reprinted from the American Journal of Psychology, vol. xxvi, Oct., 1915. 495-524.

The author here takes up in detail some of the attacks that have been made upon the concept of self as a fundamental one in psychology, and reviews the work of Katzaroff, Mischotte and Pruem, Ach, and others, showing how the concept of self is at least implicit in all their work. She explains why the self can never be discovered by pure introspection, and is, therefore, ruled out of court by those who can see no place for anything but an introspective psychology.

WILLIAM E. CARSON. *The Marriage Revolt. A Study of Marriage and Divorce.* New York: Hearst's International Library Co., 1915. Pp. xiv, 481. \$2.00.

The object of this book is "to present the facts and opinions that have led to what appears to be a wide-spread revolt against conventional marriage and an equally widespread increase of divorce; next, to discover to what extent any new definite conceptions emerging from the conflict are finding acceptance; and lastly, from an exam-

ination and analysis of causes and effects to obtain a forecast of probable future results." There are chapters on woman's emancipation and its influence on family life, the ideal marriage, the increase of divorce, experiments in the enactments of state laws, the workings of the court of domestic relations, a study of the divorce colony at Reno, Nevada, divorce problems in England, the influence of modern scientific thought on marriage, and suggested remedies for present evils. It is a broad-minded and unbiased survey of present tendencies on this important social topic.

C. H. CLAUDY. *"Tell-Me-Why" Stories about Color and Sound.* New York: Robert M. McBride and Company, 1915. Pp. 235. \$1.25.

In the ten chapters of this book the author sets forth in almost startlingly unconventional form the origins of music and pictorial art. "The Story of the Law of Wiggle" sets forth the essential phenomena of vibration, "The Story of the First-of-all First Fifes," deals with the development of wood wind instruments, "The Story of the Light Children" is an account of the spectrum, and other stories recount the development of music and painting as arts.

CAROLINE CRAWFORD AND ELIZABETH ROSE FOGG. *The Rhythms of Childhood.* New York: The A. S. Barnes Company, 1915. Pp. 84. \$1.50.

This little book of rhythms gives some of the patterns or designs that are universal expressions in all child activity, and calls them by names that suggest the mood as well as the action. In order to show the relation between the child's art expression and the evolution of the dramatic arts a selection of folk music similar in mood and type is placed opposite each rhythmic form. We have tried these little tunes with children and have found that their appeal is immediate and direct. The book can be enthusiastically recommended to kindergarten and primary teachers.

ELLWOOD P. CUBBERLEY AND EDWARD C. ELLIOTT. *State and County School Administration. Volume 2, Source Book.* New York: The Macmillan Company, 1915. Pp. xxi, 729. \$2.00.

The authors have rendered a valuable service in getting together into one volume the widely scattered material dealing with state and county school administration. This is a companion volume to a textbook of Principles of State and County School Administration, which is in preparation and may be expected in the near future. The material in the present volume is arranged in seven divisions as follows: I. American Federal and State Policy, II. State Administrative Organization, III. Extent of the Educational System, IV.

Financing the School System, V. Material Environment and Equipment, VI. The State and the Teacher, VII. The Oversight of the State. The volume is packed from cover to cover with data which are of importance and interest to the school administrator.

Educational Directory 1915-16. Bulletin 1915 No. 43, Washington: Bureau of Education. Pp. 192.

Contains lists of national and state educational authorities, city and county superintendents, trustees and presidents of universities and colleges, professors of pedagogy in universities and colleges, principals of normal and kindergarten training schools, superintendents of schools for the blind, deaf, and feeble-minded, librarians, educational foundations, educational periodicals, and educational officials in foreign countries.

C. TRUMAN GRAY. *A Score Card for the Measurement of Handwriting.* Bulletin of the University of Texas, 1915. No. 37. Pp. 50.

The author's problem is two-fold, involving the determination of the elements of handwriting, and the assignment of relative values to these elements. There is an introductory chapter on educational measurements and the use of the score card in education, an account of the determination of the points which enter into the score card, and the evaluation of these points on the basis of the judgments of teachers and supervisors of writing, of elementary school teachers, and of teachers and students of education. The weighting of the various rubrics was determined by the Thorndike method and by the method of the regression equation, as recently employed by Dr. Truman L. Kelley. The monograph constitutes an interesting contribution to the subject of educational measurements.

EDWARD CARY HAYES. *Introduction to the Study of Sociology.* New York: D. Appleton and Company, 1915. Pp. xviii, 718. \$2.50.

This work discusses in detail the practical social problems of our day and shows clearly how the individual personality is shaped by society, including the society of the school, the playground, and the home; how society is shaped by natural causes; and how it may be modified by the coöperative endeavor of individuals. The publishers claim that it is the only comprehensive work on sociology that leads up to and culminates in a treatment of the problems of education from the sociological point of view. Part One discusses the causes which affect the life of society, including geographic conditions, rural or urban conditions, the distribution of wealth, heredity, and eugenics, immigration, public health, and social suggestion. In Part Two the nature of the life of society is outlined, and social activities are analyzed and classified. Part Three treats of social evolution, and Part Four of social control, including the growth of law, crime, its causes and treatment, religion, politics, and education.

WILLIAM HEALY. *Honesty. A Study of the Causes and Treatment of Dishonesty among Children.* Childhood and Youth Series. Indianapolis: The Bobbs-Merrill Co., 1915. Pp. 220. \$1.00.

As advisor to the Judge of the Juvenile Court of Chicago the author has had exceptional opportunities to study all types of deviation from accepted standards of honesty and to identify the essential motives leading to dishonesty. The results of his observations are here set forth in simple, non-technical style for the benefit of teachers and parents. Some of the more important chapter headings are home conditions and parental behavior, companionship, discipline, amusement and adventure, mental, physical, and social habits, and dishonesty as an outgrowth of various forms of abnormal mentality.

JOSEPH LINDSEY HENDERSON. *State Systems of High School Inspection.* Reprinted from Educational Administration and Supervision, Vol. 1, No. 8, Oct., 1915. 493-510.

A summary of current methods of high school inspection by states.

ARTHUR HOLMES. *Backward Children.* Childhood and Youth Series. Indianapolis: The Bobbs-Merrill Co., 1915. Pp. 247. \$1.00.

"We are these days hearing and reading a good deal about backward children. When is a child backward? May he be backward in some ways and forward in others? Are children backward by birth or are they made so by neglect or bad methods of training? What are the signs of backwardness? Is there any way of determining accurately whether or not a given child is permanently arrested? Could the parents and the teacher help an unfortunate child if they could early detect his shortcomings? What part do physical causes play in mental and moral backwardness? These and similar questions it is the purpose of this volume to discuss in a scientific but at the same time simple, concrete and practical way." This quotation from the editor's introduction indicates the aim of the present book. The questions are answered largely by the citation of specific cases, and this gives the book an anecdotal character which makes it very interesting reading.

FRANK MITCHELL LEAVITT AND EDITH BROWN. *Prevocational Education in the Public Schools.* Boston: Houghton Mifflin Company, 1915. vii, 245.

The authors of this work have collected and organized data which have been derived during the past three years from an experimental industrial class in the University of Chicago and the prevocational classes in the Albert G. Lane Technical High School. They have

also studied the prevocational work in other cities, and the book is, therefore, representative of the most advanced thinking in this field. Among the questions discussed are the place of prevocational work in the school system, local aspects of vocational education, the best method of inaugurating prevocational classes, characteristics of prevocational boys, and the appropriate subject-matter for such classes, including physiology and hygiene, history, science, English, mathematics, shop-work, and drawing.

Report of a Survey of the School System of Salt Lake City, Utah. Salt Lake City: Board of Education, 1915. Pp. xiii, 324.

This survey was authorized by the Board of Education, May 4, 1915, and was carried out by Ellwood P. Cubberley, Director, Jas. H. Van Sickle, Louis M. Terman, Jesse E. Sears, and J. Harold Williams, all, with the exception of Superintendent Van Sickle connected with Leland Stanford University. Part One deals with organization and administration, and discusses the character of the city and its needs, the organization of the school system and its defects, the administration of the educational department and the part played therein by the school principals, the good and bad features of the teacher situation, and the increase in school census and school attendance. Part Two deals with the work of the schools, including the printed courses of study, the instruction and supervision as seen by the members of the survey, measurements of the efficiency of the instruction, and the progress of children through the schools. Part Three describes the school plant, summarizes the arrangements for health supervision, and the general status of health among school children, and discusses the physical education, playground activities and hygiene teaching in the schools. Part Four deals with school finances, and in an appendix is suggested a law for the management of Salt Lake City School District. In measuring the efficiency of the instruction, tests were given in reading, writing, spelling, composition, and arithmetic. In spelling, the Ayres Springfield test was used, and the results show that Salt Lake City schools rank well above those in other cities in all grades except the eighth. A composition test was given and the papers were scored by the use of the Hillegas scale. A dictation test was given to indicate the handwriting of the pupils and this was scored by the Thorndike scale. The Courtis tests in reading and arithmetic were employed and the Stone series of arithmetical problems was used to test reasoning in arithmetic. In arithmetic work pupils of Salt Lake City are distinctly in advance of other city systems that have been measured.

MARIE L. SHEDLOCK. *The Art of the Story-Teller.* New York: D. Appleton and Company, 1915. Pp. xvii, 288. \$1.50.

"Some day we shall have a science of education comparable to the science of medicine; but even when that day arrives the *art* of education will still remain the inspiration and the guide of all wise-

teachers. The laws that regulate our physical and mental development will be reduced to order; but the impulses which lead each new generation to play its way into possession of all that is best in life will still have to be interpreted for us by the artists who, with the wisdom of years, have not lost the direct vision of children." Thus speaks Earl Barnes in his introduction to this book, and he recommends the author as one who is equally at home in interpreting the wit and wisdom of Daudet, the folk-lore of Grimm, and the deeper world philosophy of Hans Christian Andersen. The author has here put together such observations and suggestions of story-telling as can be put into words. There are chapters on the difficulty of the story, the artifices of story-telling, elements to avoid and to seek, and hints on how to maintain the effect of the story. Part Two contains a series of eighteen carefully selected stories with an appeal to children, and Part Three gives a bibliography of sources that will be useful to the story-teller.

JAMES MONROE TAYLOR AND ELIZABETH HAZELTON HAIGHT. *Vassar*. New York: Oxford University Press, 1915. Pp. 232.

This authoritative history of the oldest college for women in America, by one who has spent the best years of his life in her service as president, will be of value for all those who are interested in the history of higher education in America. The book is in some sense a sequel to Dr. Taylor's earlier work "Before Vassar Opened" which appeared some months ago. Founded in 1865, the college has gone through three more or less distinct periods—the period of development, from 1865 to 1878, the period of discouragement, from 1878 to 1885, and the period of expansion, from 1886 to the present. An interesting exhibit in the appendix is a comparison of the financial summary for 1878 with that for 1914.

J. E. TOLSON. *Scissors Stories or Picture Cutting for Little People*. New York: E. P. Dutton and Company, 1915. Pp. xvi, 160. \$1.00.

The delight in paper-cutting is one of the earliest manifestations of constructive ability, and this interest, according to the author, can be utilized as a valuable educational process, if properly organized and stimulated. The author believes that the application of mass cutting is very wide and as a hand-maid to drawing and handwork generally it ranks very high. It gives great scope to original and imaginative work, and children should be encouraged from the first to build their own pictures. Among the topics considered are paper-tearing, paper-folding, straight line cutting, cuttings from the square and the oblong, cutting illustrations for stories, picture cutting in connection with the recitation, as in geography and history, cutting to illustrate trades, sports, and the week's work, cutting applied to

reading and language training, and dictated cutting. The book contains 135 illustrations, and forms an excellent manual in the hands of an ingenious teacher.

WILLIAM T. WHITNEY. *The Socialized Recitation*. New York: The A. S. Barnes Company, 1915. Pp. x, 100.

We hear much good sermonizing about the desirability of socializing the recitation, but the difficulties in actually carrying this advice into practice are so great that the average teacher falls back upon the mechanical routine of the traditional recitation as a vastly easier method of procedure. The present little book was written not only with the aim of inculcating the desirability of socializing the recitation, but with the purpose of showing by means of concrete examples how teachers may put the plan into execution. There are chapters on socializing the history period, the socialization of the arithmetic period, socializing oral reading. Over half of the book is devoted to actual illustrative lessons, which were taken down stenographically as they were taught to children. The book should prove helpful and stimulating to elementary teachers.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

THE KANSAS SILENT READING TESTS

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In devising tests to be used in measuring any sort of educational product in the public schools, four criteria must always be kept in mind; first, the test should be designed to measure some product of the public schools really worth measuring; second, it should be so simple in its arrangement and in the plan for giving it and scoring the results derived from it that a teacher unskilled in the use of standard tests can understand without difficulty what is expected of her in giving and scoring the test; third, it should be devised to measure progress in the acquisition of a certain ability as well as present standing of the pupils in that ability; fourth, the time consumed in giving the test and in doing the necessary work for scoring should not be so great as to make teachers who do the work feel that it is a task out of proportion to the good derived from doing it. In devising the *Kansas Silent Reading Test* these four criteria were observed throughout.

There has always been a demand on the part of teachers to know how effectively they are developing in their children the ability to get meaning from the printed page. Nothing is more fundamentally important in our school work than the development of this ability. It has been suspected too, that not only do children in the same school room differ very widely with respect to this ability but also that children in one school differ very widely as a group from children of the same grade in another

school, in this ability. This latter situation has been thought to be due in part, at least, to the differences in the conception of reading held by various school superintendents and teachers. One city emphasizes oral reading with stress upon pronunciation and enunciation, while another school emphasizes silent reading, the test being the amount of meaning which children are able to get from the printed page. Since we believe that the more important of these two phases is the one in which stress is placed upon the ability to get meaning from the printed page, we set out to derive tests to measure that ability.

The ability to get meaning from the printed page is a complex thing dependent upon many different factors. However, the two main factors, each one dependent upon a variety of causes, are the speed with which the reader can get over the lines and the accuracy with which he can comprehend the meaning of the lines. It has been customary in previous reading tests, such as Starch's,¹ to measure speed and comprehension separately. In the interest of simplicity we wished to combine in a single mark these two factors. Consequently the plan was to measure the child's ability to read by the number of the reading exercises which he could comprehend accurately within a given time. A child's low mark secured in such a test might be due to his slow rate of reading or to his poor comprehension but in either case the teacher could determine by examining the child's paper which factor was responsible for his mark.

The further difficulty arises of measuring comprehension without measuring it in terms of the ability to reproduce meaning in a written composition. It is generally agreed, I think, that the ability to reproduce is quite a separate ability from the ability to get meaning and, therefore, it seems advisable to have a test of the ability to get meaning which involves a minimum of reproduction.

Having decided this much of the plan, we secured the co-operation of a large number of superintendents in city schools in Kansas in working out the tests to fulfill these requirements. Exercises which should meet the following qualifications were called for:

¹DANIEL STARCH. *The Measurement of Efficiency in Reading, Writing, Spelling and English*. Published by The College Book Store, Madison, Wisconsin.

First, the exercises must be subject to but one interpretation.

Second, they must call for but one thing so that the answer given to them would be wholly right or wholly wrong, and not partly right and partly wrong.

Third, they must test the ability to get meaning from the printed page and must not depend for their difficulty upon obscure words nor upon any particular fund of information.

Several hundreds of such exercises were submitted and out of them approximately two hundred seemed to meet fairly well the requirements set forth above and they were evaluated statistically. From these two hundred, the forty-eight which comprise the three tests reproduced below were selected.

TEST I, FOR GRADES 3, 4 AND 5

Directions for Giving the Tests

After telling the children not to open the papers, ask the children on the front seats to distribute the papers, placing one upon the desk of each pupil in the class. Have each child fill in the blank space at the top of this page. Then make clear the following:

Instructions to be Read by Teacher and Pupils Together

This little five-minute game is given to see how quickly and accurately pupils can read silently. To show what sort of game it is, let us read this:

Below are given the names of four animals. Draw a line around the name of each animal that is useful on the farm:

cow tiger rat wolf

This exercise tells us to draw a line around the word, cow. No other answer is right. Even if a line is drawn *under* the word cow, the exercise is wrong, and counts nothing. The game consists of a lot of just such exercises, so it is wise to study each exercise carefully enough to be sure that you know exactly what you are asked to do. The number of exercises which you can finish thus in five minutes will make your score, so do them as fast as you can, being sure to do them right. Stop at once when time is called. Do not open the papers until told, so that all may begin at the same time.

The teacher should then be sure that each pupil has a good pencil or pen. Note the minute and second by the watch, and say, *begin*.

Allow exactly five minutes.

Answer no questions of the pupils which arise from not understanding what to do with any given exercise.

When time is up say *stop* and then collect the papers at once.

No. 1. Value 1.2

I have red, green and yellow papers in my hand. If I place red and green papers on the chair, which color do I still have in my hand?

No. 2. Value 1.2

Think of the thickness of the peelings of apples and oranges. Put a line around the name of the fruit having the thinner peeling.

apples oranges

No. 3. Value 1.4

Three words are given below. One of them has been left out of this sentence: I cannot ——— the girl who has the flag. Draw a line around the word which is needed in the above sentence.

red see come

No. 4. Value 1.4

There are seven boys and twelve girls in a room. If there are more boys than girls, write boys on the line below. If more girls than boys, write girls on the line below.

No. 5. Value 1.6

If you would rather have a dollar than a little stone, do not put a line under dollar, but if you would rather have five dollars than a pencil, put a line under stone.

dollar stone

No. 6. Value 1.7

The first letter in the alphabet is "a." Below are some words containing the letter "a." Draw a line under the one in which the first letter of the alphabet is found the greatest number of times.

hat easy baby age alas manfully

No. 7. Value 1.8

A child wrote these letters on the blackboard, b y a k. He then rubbed out one letter and put c in its place. He then had b y c k on the blackboard. What was the letter which he erased?

No. 8. Value 1.9

Count the letters in each of the words written below. You will find that pumpkin has seven letters, and thanks has six letters. One of the words has five letters in it. If you can find the one having five letters, draw a line around it.

breeze thanks yours pumpkin duck

No. 9. Value 2.0

Here are some names of things. Put a line around the name of the one which is most nearly round in every way like a ball.

saucer teacup orange pear arm

No. 10. Value 2.1

A recipe calls for milk, sugar, cornstarch and eggs. I have milk, sugar and eggs. What must I get before I can use the recipe?

No. 11. Value 2.2

We planted three trees in a row. The first one was nine feet tall and the last one was three feet shorter than the first one. The middle one was two feet taller than the last one. How tall was the middle one?

No. 12. Value 2.2

Below are three lines. If the middle is the longest, put a cross after the last line. If the last line is the longest, put a cross after the first line. If the first line is the longest put a circle in front of the middle line.

No. 13. Value 3.1

Three men have to walk to a town ten miles away. Each man carries a load. The first carries 25 pounds, the second 30 pounds, and the third 40 pounds. The heavier the load the slower the man travels. In order that they may arrive in town at the same time, which man must start first?

No. 14. Value 3.5

My house faces the street. If a boy passes my house going to school in the morning, walking toward the rising sun, with my house on his right hand, which direction does my house face?

No. 15. Value 4.8

Fred has eight marbles. Mary said to him: "If you will give me four of your marbles, I will have three times as many as you will then have." How many marbles do they both have together?

No. 16. Value 8.9

If in the following words e comes right after a more times than e comes just after i, then put a line under each word containing an e and an i, but if e comes just before a more often than right after i, then put a line under each word containing an a and an e.

receive

feather

teacher

believe

TEST II, FOR GRADES 6, 7 AND 8

No. 1. Value 1.0

The air near the ceiling of a room is warm, while that on the floor is cold. Two boys are in the room, James on the floor and Harry on a box eight feet high. Which boy has the warmer place?

No. 2. Value 1.3

If gray is darker than white and black is darker than gray, what color of those named in this sentence is lighter than gray?

No. 3. Value 1.6

We can see through glass, so we call it transparent. We cannot see through iron, so we call it opaque. Is black ink opaque, or is it transparent?

No. 4. Value 2.0

My shepherd dog can run faster than any of my father's large herd of cattle, but he will not chase a rabbit because he learned long ago that a rabbit can easily out-run him. If my dog is no slower than other shepherd dogs, draw a line under the fastest runner of the three animals named below.

rabbit	shepherd dog	cow
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No. 5. Value 2.2

If you find a word in this sentence which may be used to denote color, draw a line under it, but if you do not find such a word, draw a line under the first word of the sentence.

No. 6. Value 2.3

In going to school, James has to pass John's house, but does not pass Frank's. If Harry goes to school with James, whose house will Harry pass, John's or Frank's?

No. 7. Value 2.4

A boy goes to school in the morning, goes home at noon for lunch, returns to school at 1 o'clock and returns home at 4 o'clock. How many times does he travel between home and school that day?

No. 8. Value 2.6

Here are two squares. Draw a line from the upper left hand corner of the small square to the lower right-hand corner of the large square.

*No. 9. Value 3.0*

A farmer puts one-half the hay from his field into the first stack, then two-thirds of what is left into a second stack, and the remainder into a third stack. Which stack is the largest?

No. 10. Value 3.9

Below are two squares and a circle. If the circle is the largest of the three, put a cross in it. If one square is smaller than the circle, put a cross in the larger square. If both squares are smaller than the circle, put a cross in the small square.

*No. 11. Value 4.0*

"The curfew tolls the knell of parting day,
The lowing herds wind slowly o'er the lea,
The ploughman homeward plods his weary way,
And leaves the world to darkness and to me."—(Gray)

Study the above quotation carefully. The author lets us know his feeling about the coming of night. If you think his feeling is one of fear and dread, underscore curfew. If his feeling is one of peace and gladness, underscore ploughman.

No. 12. Value 4.0

Read these carefully:

Bears are larger than bugs.

Houses are larger than bears.

Mountains are larger than houses.

Then bugs are not as large as mountains.

I have tried to make no false statement among these four. If I have succeeded, underline the word success. If I have failed, underline the word failure.

success

failure

No. 13. Value 4.3

If a man takes an hour to walk around a square each side of which is a mile in length, how long will it take him to walk eight miles?

No. 14. Value 4.9

A list of words is given below. One of them is needed to complete the thought in the following sentence: The roads became muddy when the snow ———

Do not put the missing word in the blank space left in the sentence, but put a cross below the word in the list which is next above the word needed in the sentence.

water

is

melted

snow

No. 15. Value 5.8

I am writing this paragraph to test your ability to read what I compose. Under-score any word in the paragraph which has the same number of letters as the third word from the beginning of the paragraph but which has none of the same letters.

No. 16. Value 10.2

My mother's birthday and mine are on the same day. We always have a round birthday cake together. We put as many candles in a row around the cake as my mother is years old but not all the candles are white ones. We use as many red ones as I am years old. This year we used ten red ones. We found that between each two red ones we had to place two white ones. How old is mother?

TEST III, FOR GRADES 9, 10, 11 AND 12

No. 1. Value 2.1

Mary is older than Nellie, and Nellie is older than Kate. Which girl is older, Mary or Kate?

No. 2. Value 3.3

My fingers were numb with cold from carrying my skates. My breath looked like steam before my face and froze into a thick frost on my muffler. My mother saw me coming and called, "Clean off your shoes and then come in and get warm." Which do you think I had on my shoes, mud or snow?

No. 3. Value 3.5

I have five plums and Mary has four plums. Jane comes along and we see that she hasn't any. We want to divide with Jane in such a way that we shall all three have the same number. I give Jane two plums. How many must Mary give her?

No. 4. Value 3.7

In the following words, find one letter which is contained in only three of them and then cross out the word which does not contain that letter.

ail

thief

live

anvil

No. 5. Value 3.8

A, B, C, and D on the line below represent four places lying in a straight line. From A to B is 4 miles, from C to D is 7 miles, from A to D is 14 miles. How far is it from B to C?

A—————B—————C—————D

No. 6. Value 4.3

Bone is composed of animal matter and mineral matter. The former gives it toughness and the latter rigidity. Yesterday I placed a bone from a chicken's leg in a bottle of acid, and found this morning that I could wrap the bone around my finger like gristle. Which kind of matter was removed from the bone?

No. 7. Value 4.4

The pitch of a tone depends on the number of vibrations made by the vibrating body in a second of time. The greater the number of vibrations per second, the higher the tone. Two bodies are made to vibrate, the former 256 times a second, and the latter 384 times a second. Which produces the lower tone, the former or the latter?

No. 8. Value 4.8

There are three horizontal lines; the first is three inches in length, the second two inches, the third one inch. We know that if the second and third lines are joined end to end the resulting line will be as long as the first line. Suppose that the first and second lines are joined end to end. How many times as long as the third line will the resulting line be?

No. 9. Value 4.9

It was a quiet, snowy day. The train was late. The ladies' waiting-room was dark, smoky and close, and the dozen women, old and young, who sat waiting impatiently, all looked cross, low spirited or stupid.

In this scene, the women probably kept their wraps on, because they wished to be ready to take the train. Pretty soon the station agent came and put more coal in the stove, which was already red-hot in spots. Do you think this made the women happier?

No. 10. Value 5.6

Below are three lines. If the first line is the shortest, place a dot above it. If the last line is shorter than the first but longer than the middle line, put a cross above the longest. If each of the other lines is longer than the last line, put a cross above the shortest line.

No. 11. Value 6.2

Four hundred fifty years ago the people of Western Europe were getting silks, perfumes, shawls, ivory, spices, and jewels from Southeastern Asia, then called the Indies. But the Turks were conquering the countries across which the goods were carried, and it seemed likely that the trade would be stopped.

In the foregoing paragraph, what was the country called from which the people of Western Europe were getting the goods named in the paragraph?

No. 12. Value 7.0

Mrs. White and I were talking. She said to me, "Nora, I learned the other day that I am five years older than your mother."

To this I answered, "Then, Mrs. White, you are just three times as old as I am." Nora is twelve years old. How old is her mother?

No. 13. Value 7.9

"Magnanimity in politics is not seldom the truest wisdom; and a great empire and little minds go together." (Burke)

Study Burke's quotation carefully. If he was in favor of territorial expansion as the goal of English politicians he was a standpatter. If he believed in the establishment of justice in human relations even at the sacrifice of territorial expansion, he was a progressive. Which was he, a standpatter or a progressive?

No. 14. Value 8.3

Without making a line on paper at all, follow these instructions in your imagination. From the right hand end of a line AB, draw a line BC at right angles to AB and half as long as AB. From the extremity of BC draw a line CD through the middle of AB, three times as long as BC. Join A and D. Do the lines in the figure enclose any surface or surfaces? If so, how many?

No. 15. Value 8.9

Suppose that I have a dry sponge which weighs a half pound, and a pan of water. The pan and the water weigh three and one-half pounds. I soak the sponge in the pan of water and wring it out into a pint measure until the measure is full. The pint of water weighs a pound. I now put the sponge into the pan of water and weigh the pan and its contents. What will the weight be?

No. 16. Value 52.0

At sea level water boils at 212 degrees above zero on the Fahrenheit thermometer, and at 100 degrees above zero on the Centigrade thermometer. The zero point on the Centigrade thermometer represents the same temperature as 32 degrees on the Fahrenheit thermometer. A change in temperature which would raise the mercury in a Centigrade thermometer 5 degrees would raise the mercury in a Fahrenheit thermometer how many degrees?

It will be noted that a certain value is assigned to each exercise. The rather involved process by which these values were derived is explained in full in a bulletin published by the Bureau of Educational Measurements and Standards of the State Normal School at Emporia, Kansas. Space will not permit of giving a full account of the method here. We must content ourselves by saying here that the value attached to each exercise indicates

the relative length of time required on the average by children of a certain grade to do the exercise correctly. Approximately sixty children did each exercise under uniform conditions and the time required was determined for each group of five children. The children who took a given exercise were from four different cities and from three different grades in each city. Thus a fairly representative group was used with each exercise.

Assuming that these values are accurately determined, it will be seen that the difference in ability represented by securing a score of seven and that of securing a score of eight is equal to the difference in ability required to secure a score of twelve and that required to secure a score of thirteen. Therefore, progress can be measured by the use of the test because an increase in the score by any number of points on the scale represents improvement equal to an increase in the score by the same number of points at any other place along the scale.

The directions for scoring the papers, will be found below:

DIRECTIONS FOR SCORING PAPERS

1. Every answer given is counted either wholly right or wholly wrong.
2. Where the child's answer is incorrect, cross out the value indicated for that exercise in the margin.
3. Add the values of the exercises which are correctly answered. This sum is the child's score.
4. Place the score in the upper right-hand corner of the front page, in the square made for that purpose.
5. As a safeguard against teacher's misreading the exercises, the following answers are given:

Correct Answers to Some of the More Difficult Exercises.

Test for Grades 3, 4, 5:

No. 11. Ans.—8.

No. 14. Ans.—north.

No. 15. Ans.—16.

No. 16. Ans.—line under feather and teacher.

Test for Grades 6, 7, 8:

No. 5. Ans.—line under if.

No. 10. Ans.—cross in the large square.

No. 11. Ans.—line under ploughman.

No. 12. Ans.—line under success.

No. 13. Ans.—2 hours.

No. 15. Ans.—line under compose.

No. 16. Ans.—30 years.

Test for Grades 9, 10, 11, 12:

No. 2. Ans.—snow.

No. 3. Ans.—1.

No. 4. Ans.—line through thief.

No. 5. Ans.—3 miles.

No. 6. Ans.—mineral matter.

No. 7. Ans.—the former.

No. 8. Ans.—5 times.

No. 9. Ans.—no.

No. 10. Ans.—cross above the shortest line.

No. 12. Ans.—31 years.

No. 13. Ans.—a progressive.

No. 14. Ans.—2 surfaces.

No. 15. Ans.—3 pounds.

No. 16. Ans.—9 degrees.

The following median scores were obtained by giving the tests in May, 1915:

Grade,	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Number of children tested,	1207	1473	1535	1264	1338	912	621	487	324	91
Median score,	6.0	9.9	13.7	13.4	16.5	18.8	22.9	25.8	26.0	28.8

Revised standards will be determined from the scores obtained during the year 1915-'16. A copy of these standards will be sent to all who report their scores to the Bureau of Educational Measurements and Standards, Emporia, Kan.

A copy of the bulletin describing the derivation of these tests will be mailed upon request.

With regard to the time involved in giving the test, in scoring the papers, in making the necessary distributions and in finding the median score for the class, naturally some variation among teachers is to be expected, but of those from whom inquiry has been made, it seems the average time required for giving the test is certainly less than fifteen minutes and the time for scoring the papers of a class of thirty-five children, making the distribution called for, and recording the median, ranges from twenty-five minutes in the lower grades to forty minutes in the upper grades. This, we believe, meets the requirements of simplicity and of the amount of time available for the teacher to administer the test.

With reference now to results which have been secured through the giving of the test, I shall not undertake to summarize the returns which are being sent in during this present school year but rather quote the results which were secured by giving the test to 9252 children in nineteen cities in Kansas in May, 1915. The accompanying Tables I, II and III show the distribution by grades of the scores made with each of the three tests. They reveal wide variation in ability in each grade. We have become accustomed to this range of ability in a given class through the use of standard tests in other common branches, but in no other

subject, we think, has variation quite so wide been revealed. For instance, in the third grade while 6.4 per cent. of the children cannot do a single exercise in five minutes, 8.1 per cent. can do exercises the sum of whose values is fifteen or more. That means more than 9 exercises of the test. While the median score is 6 in the third grade, one child in 6 can do twice as many and can secure a score of at least 12.

Another striking fact is apparent from these tables. There are some children in nearly all the grades who cannot do any of the exercises called for in 5 minutes while the median scores increase from grade to grade by approximately 3 points. Certain children are being promoted from grade to grade even though they cannot gain perceptibly in reading ability. Allowing for the few cases where normal intelligence is absent the wide variation among the pupils who are supposed to be able to do the same work in school indicates a serious problem confronting the teacher. Assignments which one-fourth of the children require 50 minutes or more to complete where the principal task is interpreting the printed page, may be done by another fourth of the class in 20 minutes or less in the case of practically all grades of children. Almost as wide variation occurs when the members of a group which is taught by a single teacher are considered instead of a combined grade group from all the schools.

One other fact stands out also in these tables. The reading ability possessed by the median child in any one grade is superior to the ability possessed by at least a third of the children in the class above him and is no better than the reading ability possessed by at least a third in the class below him. The differentiation, therefore, in reading ability from year to year is insignificant in comparison with the wide difference in ability among the children in any given year or grade. The over-lapping of ability from grade to grade can be seen by following across the table from left to right and noting that most of the scores are represented in practically all grades.

From the list of the medians at the bottom of the tables, it will be observed that there is an abrupt break in the scores between fifth and sixth grades and a less abrupt but nevertheless certain break between the eighth and ninth grades. These breaks are due to the fact that one test was given to grades 3, 4 and 5 and another test to grades 6, 7 and 8 and a third test to grades 9,

TABLE I.

Distributions, by grades, of scores, both whole numbers and percents., secured by children in 19 cities using Test I of the Kansas Silent Reading Tests.

Scores Between	Grade III		Grade IV		Grade V	
	No. of Children	Per Cent. of Children	No. of Children	Per Cent. of Children	No. of Children	Per Cent. of Children
0- .9	77	6.4	29	1.9	4	.2
1- 1.9	89	7.4	30	2.0	10	.6
2- 2.9	125	10.4	40	2.7	20	1.3
3- 3.9	81	6.7	33	2.2	17	1.1
4- 4.9	102	8.5	80	5.4	32	2.1
5- 6.9	261	21.7	228	15.5	111	7.2
7- 8.9	158	13.2	213	14.5	165	10.8
9-10.9	94	7.8	194	13.2	163	10.6
11-12.9	64	5.3	172	11.7	172	11.2
13-14.9	61	5.1	170	11.5	204	13.3
15-17.9	46	3.8	128	8.7	226	14.8
18-20.9	28	2.3	94	6.4	207	13.5
21-23.9	8	.7	40	2.7	112	7.3
24-26.9	5	.4	9	.6	34	2.2
27-29.9	3	.3	7	.5	27	1.7
30-34.9	4	.3	4	.3	12	.8
35-39.9	1	.1	2	.2	14	.9
40-44.9					5	.3
45-49.9						
50-59.9						
60-69.9						
80-above						
Total No. Children and Median Scores	1207	6.0	1473	9.9	1535	13.7

TABLE II.

Distribution, by grades, of scores, both whole numbers and per cents., secured by children in 19 cities using Test II of the Kansas Silent Reading Tests.

Scores Between	Grade VI		Grade VII		Grade VIII	
	No. of Children	Per Cent. of Children	No. of Children	Per Cent. of Children	No. of Children	Per Cent. of Children
0- 9	13	1.0	3	.2	1	.1
1- 1.9	9	.7	1	.1	2	.2
2- 2.9	17	1.3	7	.5	4	.4
3- 3.9	20	1.6	11	.8	8	.9
4- 4.9	35	2.8	14	1.0	4	.4
5- 6.9	89	7.1	41	3.1	30	3.3
7- 8.9	140	11.1	66	4.9	33	3.6
9-10.9	153	12.1	93	7.0	60	6.6
11-12.9	132	10.5	105	7.9	84	9.2
13-14.9	107	8.5	141	10.6	65	7.1
15-17.9	163	12.9	238	17.9	125	13.7
18-20.9	146	11.6	199	14.9	146	16.0
21-23.9	86	6.8	147	11.0	91	10.0
24-26.9	61	4.8	114	8.6	93	10.2
27-29.9	28	2.2	52	3.9	40	4.4
30-34.9	34	2.7	78	5.9	73	8.0
35-39.9	5	.4	19	1.4	25	2.8
40-44.9	2	.1	4	.3	18	2.0
45-49.9	7	.5	3	.2	7	.8
50-59.9	17	1.3	2	.1	3	.3
60-69.9						
70-79.9						
80-above						
Total No. Children and Median Scores	1264	13.4	1338	16.5	912	18.8

TABLE III.

Distributions, by grades, of scores, both whole numbers and per cents., secured by children in 19 cities using Test III of the Kansas Silent Reading Tests.

Scores Between	Grade IX		Grade X		Grade XI		Grade XII	
	No. of Child- ren	Per Cent. of Children	No. of Child- ren	Per Cent. of Children	No. of Child- ren	Per Cent. of Children	No. of Child- ren	Per Cent. of Children
0- .9	2	.4	3	.6				
1- 1.9								
2- 2.9			1	.2				
3- 3.9	3	.5	4	.8				
4- 4.9	2	.4			1	.3		
5- 6.9	7	1.2	6	1.2	3	.9		
7- 8.9	15	2.4	9	1.8	5	1.5		
9-10.9	25	4.1	8	1.6	9	2.8	1	1.1
11-12.9	32	5.2	14	2.9	14	4.3	1	1.1
13-14.9	35	5.7	15	3.1	14	4.3	3	3.3
15-17.9	68	11.0	54	11.2	34	10.6	8	8.8
18-20.9	83	13.4	41	8.5	19	5.9	6	6.6
21-23.9	63	10.2	46	9.5	28	8.7	6	6.6
24-26.9	87	14.1	72	14.9	54	16.8	15	16.6
27-29.9	44	7.1	39	8.1	35	10.9	10	11.0
30-34.9	69	11.2	77	16.0	50	15.6	20	22.2
35-39.9	28	4.5	46	9.5	24	7.4	6	6.6
40-44.9	23	3.7	30	6.2	20	6.2	10	11.1
45-49.9	19	3.1	12	2.4	8	2.4	3	3.3
50-59.9	12	2.0	5	1.0	5	1.5	2	2.2
60-69.9	3	.5			2	.6		
70-79.9	1	.2	2	.4				
80-above			3	.6				
Total No. Children and Median Scores	621	22.9	487	25.8	324	26.0	91	28.8

10, 11 and 12. Our work with the scores has shown us that although it was hoped that the values attached to the exercises in the three tests would make the scores secured comparable throughout all the grades, this is not exactly the case. In a group of 399 fifth grade children who took the test designed for grades 3, 4 and 5 and also the test for grades 6, 7 and 8 the median score of 13.46 was made on the test for grades 3, 4 and 5 while a median score of 11.66 was made by the same children in the test for grades 6, 7 and 8. It appears, therefore, that a difference in difficulty of approximately 2 points on a median score of 11 to 13 points is present in these two tests. Similarly 243 children in the eighth grade made a median score of 19.75 points on the test for grades 6, 7 and 8, but made a median score of 25.1 on the test for 9, 10, 11 and 12. These differences indicate imperfections in the values attached to the exercises. They do not, however, seriously invalidate the comparisons made among different members in the same class or among different classes of the same grade when tested by the same exercises. It does make it impossible to estimate the improvement between fifth and sixth grades or between eighth and ninth grades by the scores obtained by these grades in the tests, without making due allowance for the differences in difficulty of the three tests.

As an interesting study of the relative scores made by children in the various cities, Table IV is given. This represents the median score of all the children of a given grade taking the test in each city. Of course, in some cases only small numbers of children were tested while in other cities relatively much larger numbers were used, but even taking that into account, it is perfectly clear that the achievement in silent reading in some cities far surpasses the achievement in other cities. For example, the median scores obtained by children in the several grades of city G are little more than half the median scores secured by children in the corresponding grades in city A. Other surprisingly wide differences might be pointed out but a glance at the table will suffice to indicate that results as measured by these tests must depend to a considerable extent upon the varying practices which dominate the reading work in the various cities. Such a table as this one extended over a large number of cities and including a large number of children in each city would form the basis of an interesting study of the efficiency of various methods employed in teaching reading.

KANSAS SILENT READING TEST, MAY, 1915

		<i>Median Scores</i>								
		3rd	4th	5th	6th	7th	8th	9th	10th	11th 12th
City	A	7.6	13.3	13.8	19.7	19.1	18.7	21.8	25.6	26.4
"	B	8.3	7.25	14.6	13.3	18.0		20.8	33.6	42.2 34.4
"	C	4.8	5.2	6.9	10.4	13.65	16.7	17.9	21.8	21.6 25.8
"	D	3.0	7.9	11.7	13.0	15.8	18.0	21.6	21.7	27.2
"	E	4.7	8.2	15.0	12.8	15.1	15.0	22.9	20.25	20.7 29.0
"	F	6.8	8.5	16.1	12.8	21.0	18.7			
"	G	3.9	5.2	6.8	8.1	12.2	8.55			
"	H	5.8	11.2	10.3	14.0	19.6	15.65			
"	I	5.2	10.3	17.55	19.1	18.3	22.4	21.6	25.6	26.7
"	J	5.4	6.8	10.3	9.7	13.0	14.6	20.7	21.2	
"	K	5.1	8.0	11.7	12.0	14.3	15.6			
"	L	6.6	14.4	13.9	16.8	20.7	21.1			
"	M	2.9	9.6	14.3	9.8	15.0	16.9	25.1	20.1	30.9 34.8
"	N	6.8	13.7	17.3	15.3	16.8	23.05	25.1	25.15	25.5 31.5
"	O	6.3	11.2	14.7	16.4	18.05	13.2			
"	P	7.9	10.0	13.8	14.3	17.6	28.0	20.7	24.4	26.0 28.9
"	Q	5.7	11.5	14.3	13.6	18.0	20.4	28.5	28.9	25.7
"	R	4.6	9.1	13.1	13.8	16.8	19.4			
"	S	5.4	9.3	12.5	8.8	14.1	22.5			
Total tested		1207	1473	1535	1264	1338	912	621	487	324 91
Medians of totals		6.0	9.9	13.7	13.4	16.5	18.8	22.9	25.8	26.0 28.8

NOTE—The cost of the Kansas Silent Reading Tests, including Class Record Sheets, is 33 cents per hundred copies. Address the Bureau of Educational Measurements and Standards, State Normal School, Emporia, Kansas.

ELEMENTARY TESTS IN PSYCHOLOGY

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It is generally assumed that the blind are keener in hearing and touch than seeing persons are. Many marvel at the performances of the blind who walk about and feel at home, guiding themselves without the use of their eyes; and, when the blind person reads his braille with his finger-tips approximately as fast as we read with our eyes, they feel thoroughly convinced that here is a case of compensation in sensitiveness: in the absence of sight, his ear and his finger-tips have become more sensitive, for a seeing person is comparatively helpless in guiding himself by hearing or touch.

Through years of experience in the laboratory, the conviction has gradually grown upon me that a more radical distinction should be made between sensitiveness and ability to use a sense; *i. e.*, between inborn sensory capacity and acquired ability or skill. From time to time I have taken the opportunity of comparing my own sensitiveness in touch and hearing with that of blind persons distinguished for ability in guiding themselves by hearing and touch; and in no case did I find that the blind persons possessed any significant superiority to myself in sensitiveness to touch and hearing, although some of the blind persons experimented upon were noted for their wonderful performances through hearing and touch.

For about fifteen years we have been collecting data in the Iowa laboratory on the features involved in pitch discrimination; and, although we started out with all previous records and theories to the contrary, it has been abundantly proved that the test of pitch discrimination may be so elemental that there can be no improvement with practice and there will appear no significant variation with age, say from the age of eight to forty. So far as I know these data are the first clear-cut demonstration of the fundamental distinction which I wish to bring out here, namely, the distinction between psycho-physic sensibility and the apprehensive use of a sense.

We may say that a test is *elemental* when it is so simple and direct that no improvement can be made in the record by training. This is a new connotation assigned to the concept "elemental," for want of a better word. It follows from this definition that, within self-evident bounds, the record of an elemental test should not vary with age or phenomenal use of the sense.

It is evident that if such elemental tests are possible, the introduction of this concept into individual psychology must be of very great importance.

With this in view, we have undertaken in the Iowa laboratory to seek verification of this principle by two distinctive lines of experiment: first, by measurement of the effect of extraordinary use of a sense not ordinarily employed as in the case of hearing and touch by the blind; and, second, by a prolonged series of training in a test which is presumably elemental. The full account of these two experiments will be published in Volume VII of the University of Iowa Studies in Psychology. Here I shall merely announce the general conclusions and point out the practical significance of these facts for educational psychology.

I. THE COMPARATIVE SENSITIVENESS OF BLIND AND SEEING PERSONS

(Experiments by Tsoerum Ling)

The fifteen brightest pupils of high school grade who had been blind for more than five years were selected in the Iowa School for the Blind at Vinton. These were compared with fifteen pupils in the Iowa City high school, selected at random—merely by taking those who happened to have a convenient schedule for the experiments. On these two groups six measurements in touch, hearing, and the kinaesthetic sense were made, which are so simple and direct that they might prove elemental so far as this test would constitute any evidence. These tests were: (1) discrimination for the direction of sound, (2) discrimination for intensity of sound, (3) discrimination for lifted weight, (4) discrimination for passive pressure, (5) discrimination for active pressure, and (6) discrimination for two points in tactual space. Most painstaking efforts were made in the adaptation of apparatus and method to make these six measurements elemental by reducing them to simple, direct impression which could be reported by the most natural response, no skill in action of any kind being involved. In other words, the aim was to establish a

physiological threshold as distinguished from a cognitive threshold.

The physiological threshold is the actual psycho-physic limit of the organism as measured under the most favorable conditions—conditions so simple and direct that they may be complied with adequately without training. The cognitive threshold, on the other hand, is any threshold that is inferior to the physiological on account of lack of skill or some cognitive or other difficulty which might be overcome by information or training.

The general result of these accurate measurements on fifteen blind and fifteen seeing persons in groups of approximately the same age are easy to generalize: *The threshold of sensory discrimination in each of these six measurements is about the same for the seeing group as for the non-seeing group.* There are certain variations, for individuals as well as for the group, but they are fairly distributed on the two sides so as to justify the general statement just made.

In the light of popular opinion, in the light of the opinion of those who are specialists in the training of sensory defective, as well as from the point of view that has generally been taken in psychological measurements on individual differences, this result is rather astonishing. Yet when one considers the case in its true setting, it seems natural enough.

We are born with prodigious resources of which the psycho-physic organism for sensory discrimination is a good illustration. We have so many avenues leading to the same goal, so many means of accomplishing the same object in sensory experience, that no individual, however accomplished, makes use of more than a very small portion of his native capacity for sensory discrimination in clearly conscious terms. The eye seems to be the most convenient and universal avenue of approach to the outer world; therefore, seeing persons use their eye in apprehending objects and *store up their experiences and form their habits* in terms of eye adjustments. Other sensory impressions accompany these and may substitute for them but ordinarily take a secondary role.

Under these circumstances two facts are to be noted: first, we have no evidence, experimental or otherwise, to prove that the psycho-physic capacity of the eye is enhanced by persistent use in the life of the individual; that is, the refractive system does not improve by practice and the retina probably does not become

more sensitive to color and brightness by use, although the meaning of impressions may grow enormously by training. And, second, we have no evidence, experimental or otherwise, to show that the ear and the tactual organs in the skin and muscles become less sensitive by non-use in *apperception* in the life-time of an individual so long as sense-stimuli are allowed to play upon these organs in a normal manner.

Take the case of the blind and the seeing, then. The blind store their experiences and carry their psycho-motor adjustments in other terms than sight. They use hearing, touch, and all the other lower senses more than seeing persons do, but we have no evidence to prove that the basilar membrane (or any other mechanism) or the sense organs of any of the other senses are improved by such use. On the other hand, the experimental evidence here reported goes to show that native sensitivity, including both sensitivity and sensory discrimination as ordinarily used, remains constant under such conditions, other things being equal.

But it may well be claimed that even the most elemental of these tests involves a certain amount of power of observation which has been acquired by training. This is true, and for this reason no test can be made absolute. A child cannot react until his general power of application has developed to such an extent that he can say that he hears or does not hear, sees or does not see, a particular object placed before him and can do this with adequate application to the task. But the point is that this general ability involved in elementary sensory discrimination is so instinctive and so direct and simple that every normal child exhibits that ability very early. In the case of pitch discrimination, *e. g.*, we have found that, with bright children, such a satisfactory elemental test can be made at the age of five, while the dull child may not have acquired that ability at the age of ten.

If we ask, then, for an interpretation of the facts before us, it may probably be summed up in this: that the elemental sensory discrimination as one feature in the mechanism of the psychophysic organism is so thoroughly established through geological ages of adjustment that the extraordinary use of it in a single lifetime will not materially change its capacity. Learning, which represents stored-up experience, with the power of reproduction and elaboration, may shift from one sense to another in response

to the exigencies in the life of the individual without disturbing the relative sensitivity of the organs involved in all normal sensory life, and all the senses are continuously at play sufficiently to prevent a deterioration.

Indeed, these sensory discriminations manifest themselves in all the senses very early in infancy. I have observed four infants during the first ten days with reference to their localization of sound, and in all four cases a surprising ability to observe the direction of a source of sound was present as soon as the infant began to notice sound at all. The fact that this process is automatic makes it possible for us to use the sense of hearing in normal life without being aware of the actual extent to which we do use it.

The interpretation here given to immediate sensory discrimination makes necessary a revision of the conventional distinction between sensitivity and discrimination in experimental psychology. Ordinarily, discrimination is used in the sense of a judgment; but in the case of the elemental measurements here involved, the reflective process is reduced to a minimum and the test becomes essentially one of immediate sensory impression allied to that of bare sensitivity.

II. THE EFFECTS OF PRACTICE ON DISCRIMINATION FOR THE INTENSITY OF SOUND

(Experiments by Kwei Tan)

The above results of trials with the six tests do not constitute complete proof of the elemental character of these tests, although they point very strongly in that direction. The conditions under which they were given may, however, be considered fairly crucial. In order to get further specific proof in regard to the elemental character of these tests, an extended study was made on one, namely, the discrimination for the intensity of sound. The problem was merely this. The observer hearing two tones, one second apart, each lasting one second, was asked: Which was the louder?

Mr. Tan, having trained himself in the manipulation of this test, and having fitted it up in the sound, light, and jar-proof room of the laboratory, took thirteen advanced students and put them through a series of exercises consisting of the repeti-

tion of these measurements, determining how small a difference in the intensity of sound the observer could detect. This was the most effective form of training we could devise. Six of these observers continued under approximately uniform conditions for twenty hour-periods each, and the other six had slightly less, varying from thirteen to seventeen periods of training. In all cases, however, it seemed that the training was long enough to reveal whether or not there was to be any progressive improvement with practice. While there were individual fluctuations and slightly characteristic variations in the so-called practice course for different observers, his general conclusion was that, where we had control of the conditions and there were no disturbing influences present, *this amount of training yielded no evidence of improvement with practice.*

In other words, we have here a test which is elemental in the sense defined above, first, as evidenced by the apparent lack of modification by blindness, and second, by failure to improve with practice.

A third step remains to be taken, namely, to determine whether or not it develops with age. A considerable number of experimenters have made measurements on children and the general conclusion of these experiments is that there is improvement with age. But such was also the finding for pitch discrimination until the most recent experiments. This may perhaps be due to the failure to realize the significance of apparently trivial conditions in the test which will tend to make or unmake it as an elemental test. In other words, for want of experimental proof on children, I would make the prediction that we should probably find that, where the child is old enough to apply himself and does apply himself intelligently to the test—say from five to ten years of age, according to the brightness of the child—the records for these six tests which were tried on the blind would not vary with age.

The findings in these experiments constitute a challenge to a large part of current systems of mental tests. They demand that, before we attribute a developmental trait to a subject, we must ascertain that such a variable is not due to our failure to recognize the significance of making tests of capacity elemental.

ON THE CORRELATION OF THE MARKS OF STUDENTS IN MATHEMATICS AND IN LAW

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In a paper¹ entitled "A Study in Formal Discipline," Mr. F. C. Lewis draws some conclusions concerning the ability of students in mathematical reasoning and in law. He bases these conclusions on an examination of records of Dartmouth students, with a view of determining whether students of high standing in mathematics tend to have relatively high standing in law. He states his result in the following form:² "These tests are surely convincing of one thing, *viz.*: that students able in mathematical reasoning are not even generally able in practical reasoning and law."

I take it as obvious that such a conclusion should not be drawn if there is a significant positive correlation between the marks of students in mathematics and in law. The statistical analysis contained in the present paper shows that there exists a significant positive correlation between grades in mathematics and grades in law. In other words, students of high standing in mathematics tend to have higher standing in law than do students of average or of low standing in mathematics. Hence, Mr. Lewis has clearly drawn false conclusions from his data.

In describing his data, Mr. Lewis states that the records of ten different classes were examined. He published³ as an example the marks of one class of twenty-four students. Attention has been called to the fact⁴ that this example illustrates exactly the opposite of his stated conclusion, in so far as it has a bearing on the question under consideration. It is unfortunate that the grades of only one of the ten classes were published, as this omission of most of the data made immediate criticism practically

¹ School Review, Vol. 13, pp. 281-292 (1905).

² Loc. cit., p. 291.

³ Loc. cit., p. 291.

⁴ RIETZ AND SHADE, *Correlation of Efficiency in Mathematics and in other Subjects*, Illinois University Studies, Vol. III, No. 1, p. 19.

impossible. In fact, when relationships are treated by means of data involving as much variability as is shown by students' marks, good statistical practice demands that a tabular arrangement of the data be published along with the results.

Since the published example does not conform to the results stated, it seems important to obtain data from Dartmouth College in order to test Mr. Lewis's conclusions by a statistical analysis of such data. At the request of Professor C. N. Haskins, the administrative officers of Dartmouth College kindly furnished me with data on students taking courses in mathematics and law at Dartmouth from 1897-1901. The example of twenty-four students cited above is marked "Dartmouth 1897." With the hope of obtaining in part the same data that Mr. Lewis used, I have included students who took mathematics and law in 1897.

These data in the form of an average grade of each student for courses in mathematics and the average grade for courses in law are exhibited for separate classes in the correlation tables marked 1897, 1898, 1899, 1900, and 1901 (Tables I-V). As the mean grades for the various years do not differ by more than may reasonably be ascribed to random sampling, the data are next grouped to form a combined table (Table VI).

The following mean grades and correlation coefficients are obtained from data for various years and for the combined data:

	1897	1898	1899
Mean Grades in Math.....	71.7 \pm 1.2	73.1 \pm 1.6	72.6 \pm 1.2
Mean Grades in Law	73.6 \pm 1.1	77.9 \pm 1.2	70.6 \pm 1.9
Correlation coefficient.....	0.38 \pm 0.10	0.675 \pm 0.070	0.611 \pm 0.085

(Continued)

	1900	1901	Comb. data
Mean Grades in Math.....	75.3 \pm 1.0	75.8 \pm 1.5	73.7 \pm 0.6
Mean Grades in Law	71.7 \pm 1.2	75.0 \pm 1.4	73.8 \pm 0.6
Correlation coefficient.....	0.537 \pm 0.067	0.672 \pm 0.070	0.528 \pm 0.040

Each of the correlation coefficients for the separate years is a significant positive correlation. These correlation coefficients vary from $r = 0.38$ to $r = 0.675$, but such a variation is not unlikely under random sampling, with as small a number of

students as we have in a single class. The correlation coefficient $r = 0.528 \pm 0.040$ for the combined data should be especially noted.

These data thus show, in every case, a positive correlation. Though in each case the number of variates is small, yet the positive correlation coefficients found are nevertheless very significant. While the number of variates used in the tables for separate years is too small to warrant the calculation of the means of arrays, we find, from the combined table, except near the extremes, that the means of arrays lie fairly near the line of regression. We can therefore predict fairly well from the correlation coefficient the average grades of students in law for assigned grades in mathematics.

From an examination of Mr. Lewis's diagram of grades (p. 291, loc. cit.), I think it is somewhat likely that the error has come from emphasizing unlikeness and giving too little or no attention to likeness. This kind of error is very common where conclusions are drawn from personal impressions of relations. The method of treating his figure on p. 290 in which he exhibits the standing in mathematical reasoning and standing in what he calls "practical reasoning" is also open to serious criticism. Here, just as with the grades in mathematics and law, he draws lines placing grades that are decidedly different into prominence, without drawing also lines to put into similar prominence cases where grades are alike or nearly alike. Such a method is manifestly unscientific. In short, it seems that Mr. Lewis has again neglected to give due weight to likeness and has drawn a further incorrect conclusion from the data on mathematics and "practical reasoning."

TABLE I
Correlation of Marks in Mathematics and in Law
1897
Mathematics

Law		50	55	60	65	70	75	80	85	90	95	100	Total
	50												
	55			1									1
	60	1	2		1	1				1			6
	65				1	1	1						3
	70			1	1		1		1				4
	75				1	2		2	1				6
	80			1	1	2	1	1	1		1		8
	85			1		3		1	2				7
	90												
	95												
	100												
	Total	1	2	4	5	9	3	4	5	1	1		35

Mean grade in Mathematics, 71.7 ± 1.2
Mean grade in Law, 73.6 ± 1.1
 $r = 0.38 \pm 0.10$

TABLE II
Correlation of Marks in Mathematics and in Law
1898
Mathematics

Law		50	55	60	65	70	75	80	85	90	95	100	Total
	50		1										1
	55												
	60	1											1
	65						1						1
	70	2		1									3
	75	1			2	1	1	2	2				9
	80			1			2		1				4
	85						1	2	1	1			5
	90					1		1	1	1			4
	95										1		1
	100												
	Total	4	1	2	2	2	5	5	5	2	1		29

Mean grade in Mathematics, 73.1 ± 1.6
Mean grade in Law, 77.9 ± 1.2
 $r = 0.675 \pm 0.070$

TABLE III

Correlation of Marks in Mathematics and in Law
1899

Mathematics

	50	55	60	65	70	75	80	85	90	95	100	Total
50		1	1			1						3
55					1							1
60			1	1	1		1					4
65							2					2
70			1	2								3
75							1	1				2
80				1								1
85				1			3					4
90							2		1			3
95												
100												
Total		1	3	5	2	1	9	1	1			23

Mean grade in Mathematics, 72.6 ± 1.2

Mean grade in Law, 70.6 ± 1.9

$$r = 0.611 \pm 0.085$$

TABLE IV

Correlation of Marks in Mathematics and in Law
1900

Mathematics

	50	55	60	65	70	75	80	85	90	95	100	Total
50		1		1			1					3
55			1	1	1	1						4
60			1		1		1	1				4
65			2				1		1			4
70	1		1	1	3	2		1				9
75					2	1	3	1				7
80						1		1	1			3
85						1	1	2	2	1		7
90					1		2					3
95										1		1
100												
Total	1	1	5	3	8	6	9	6	4	2		45

Mean grade in Mathematics, 75.3 ± 1.0

Mean grade in Law, 71.7 ± 1.2

$$r = 0.537 \pm 0.067$$

TABLE V
Correlation of Marks in Mathematics and in Law
1901
Mathematics

Law		50	55	60	65	70	75	80	85	90	95	100	Total
	50				1								1
	55		1		1								2
	60		1	1									2
	65				1	1							2
	70						1	1		2			4
	75			1		2							3
	80				1		1	2	1				5
	85					1	1	4			2		8
	90										2		2
	95												
	100												
	Total		2	2	4	4	3	7	1	2	4		29

Mean grade in Mathematics, 75.8 ± 1.5
Mean grade in Law, 75.0 ± 1.4
 $r = 0.672 \pm 0.070$

TABLE VI
Correlation of Marks in Mathematics and in Law
COMBINED TABLE—1897-1901
Mathematics

Law		50	55	60	65	70	75	80	85	90	95	100	Total
	50		3	1	2		1	1					8
	55		1	2	2	2	1						8
	60	2	3	3	2	3		2	1	1			17
	65			2	2	2	2	3		1			12
	70	3		4	4	3	4	1	2	2			23
	75	1		1	3	7	2	8	5				27
	80			2	3	2	5	3	4	1	1		21
	85			1	1	4	3	11	5	3	3		31
	90					2		5	1	2	2		12
	95										2		2
	100												
	Total	6	7	16	19	25	18	34	18	10	8		161

Mean grade in Mathematics, 73.7 ± 0.60
Mean grade in Law, 73.8 ± 0.60
 $r = 0.528 \pm 0.040$

ADDITIONAL RESEARCHES ON LEARNING TO SPELL:
THE QUESTIONS OF "TRANSFER" AND OF
"DIRECT" VERSUS "INDIRECT"
METHODS¹

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THE FIRST EXPERIMENT

The problem of this experiment may be expressed thus: Is there any "transfer" of accuracy from words learnt in lists to cursive dictation embodying the words thus learnt? I use the word "transfer" in the sense in which it is used in pedagogical discussions of this question, especially in America, though from a psychological standpoint, "transfer" is not really involved at all. All that is meant is: Are words learnt in one "setting," so to speak, available in another?

The experiment was carried out with the whole of a Standard I class of 56 boys, of an average age of 7 years 5 months. Most of the boys could read fairly, but though they knew the names and sounds of the letters, their spelling was but little advanced. Twenty-four common words were taught in lessons lasting about fifteen minutes each in the early part of four afternoon sessions. The words were learnt in the following way: Each of the twenty-four words was written in script on large sheets of cartridge paper (11 in. x 15 in.). The boys were provided with paper and pens, and the first word was exposed to view. The experimenter spelled and pronounced the word, and the boys were told to spell it through as many times as they could, silently, that is, without audible articulation, though in actual practice, there was some muttering. After an exposure of 25 seconds the boys wrote the word on their papers. The next word was exposed and written in the same way and twelve words were thus dealt with in the first lesson. The next day the remaining twelve words were similarly dealt with. On the two following days the whole of the words were treated again in the same way.

After an interval of four days, the words were dictated as a list. The experimenter placed each word in a sentence thus: "Where are you going?" He called out the whole sentence and then said, "Write down 'where,'" and so on, throughout the list. On the next day the boys were told the results of their "list spellings," but no corrections were made and no further teaching was done, except to explain and illustrate the difference between "hear" and "here," which had been confused.

Two days later the following sentences, containing some of the words from the list, were dictated:

Will you *scrub* the table with *soap*?

Here is the *needle* and *cotton*.

I can *hear* a boy *read*.

Hang up the *towel* when you *finish*.

The "list words" are italicized. The time taken was 20 minutes.

In making the analysis, some of the words in the dictation were not counted. There were left 8 specially taught words and 11 words not so treated. The taught words were: scrub, soap, needle, cotton, hear, read, towel, finish. The untaught words were: will, you, the, table, with, is, and, can, boy, up, when.

For the whole group of 56 boys the average number of list spellings correct was 5.6 (68.6 per cent.), the average number of taught words correctly spelled in cursive dictation was 5.7 (70.9 per cent.) and the average number of untaught words correctly spelled in cursive dictation was 8 (72.5 per cent.).

The correlation-coefficient was worked out from the individual cases by the Pearson "r" formula between the accuracy of the "taught" words in the list and that of the same words in the dictation. It reached the high figure of + .897. It appears that the words were done better in dictation than in the list, but not much. The difference between the two averages is only .1, and the "probable error" of this difference, worked out on the formula " $p. e. = .67 \sqrt{\frac{\sigma_1^2 + \sigma_2^2 - 2r\sigma_1\sigma_2}{n}}$ " is also .1. We are not justified, therefore, statistically, in asserting a general rise, since the difference between the means is less than "two or three times" its probable error.

¹ This article is condensed from the author's manuscript of fifty-five pages. The author is not responsible for errors, omissions, or misstatements due to the condensation.—Managing Editor.

Conclusions

1. Words learnt by a direct method which can be written correctly in lists can also be written correctly among others in cursive dictation.

2. Easier words, not directly taught, are spelled as badly as much harder words, directly taught, so that even for the easier words some "direct" treatment seems advisable.

3. It is well-known now that children remember more some time after than they do immediately after a lesson, provided they have made efforts in acquisition. The slightly better result in the dictation may be due to this factor or to the practice involved in writing the list or to both. But the operation of the former factor may be small; since, in order to eliminate it to some extent, the list spellings were given four days after the lessons were over, and the dictation was given on the day following the list spellings.

THE SECOND EXPERIMENT

This experiment dealt also with the question of "transfer"; but there were important differences from the first experiment. An attempt was made by means of equal, parallel and highly-correlated groups of boys to demonstrate the comparative results of "direct" and "indirect" teaching. And the words which were learnt were selected in such a way that they were indubitably words which were within the children's vocabulary, and which they could use with appropriate meanings in sentences of their own.

The class which did the work was a Standard I class of some 50 children in a senior department of an average age of 7 years 11 months. The majority of the boys had been working in this class for some nine months, though thirteen of them had been in the class but three months. On four successive days, from 3:20 to 3:50 p. m., immediately after the recreation interval, the boys wrote exercises involving productive imagination. Four words were written on the black-board in each case, and the children were told to write a story containing these words, a form of exercise quite new to them. I have previously pointed out the value of this form of test as a measurement of imagination.² Its defect as a mental test is the high improbability by

² W. H. WINCH. *The Relation Between Substance Memory and Productive Imagination in School Children*. British Journal of Psychology. Vol. 4, 1911, 92-125.

practice of its productive aspect, but that will not affect the questions raised in this research; for I am now using it as a means of inducing linguistic expression in young children in order to find out the words they use and which of them they misspell. First of all, the spelling errors were marked on each paper. Then a tabulation was made in order to discover the words most frequently used and most frequently spelt wrongly. Finally, from the completed table, the following forty words were selected as satisfying these conditions:

went	sweets	know	caught
who	once	said	catch
father	eating	sitting	threw
mother	know	killed	used
when	played	flight	down
you	saw	house	pick
give	upon	time	bought
gave	see	little	with
some	have	buy	his
come	was	which	home

The forty selected words listed above were dictated to the class, and on the results obtained two parallel and highly-correlated groups equal in spelling ability (so far as these words are concerned) are formed.

The selected words were taught to the two groups by two different methods. The Head Master taught one group by a "direct" method, and an Assistant Master taught the other group by an "indirect" method. Each teacher believed in his own method and was enthusiastic about it. The lessons taken by the Assistant Master will be cited first.

The word "you" from the list was written on the blackboard, and the boys were asked to give orally sentences containing "you." Then the word "know," also from the list, was written and the boys were asked to form sentences containing "you" and "know." Then the word "father" was added, also of course, from the list, and then "who" and "bought" and "sweets." So the sentences would grow in this way. The words from the list are italicized.

1. *You* are a good boy.
2. *You know* my father.
3. *You know* who did it.
4. *You know* who bought it.
5. *You know* who bought the sweets.

From a number of such sentences given by the boys, one was chosen by the teacher and dictated slowly. In this case sentence number five was chosen. The boys all wrote the sentence looking at the board for the words "you," "father," "who," "bought," "sweets" if they were in any doubt about their correct spelling.

Then the words "which," "said," "saw," "fight," were dealt with in the same way, and the sentence selected for dictation was in this case "*Which* is the boy who said he saw a fight?"

"Once upon a time" (written as a phrase), "father," "went," "home," "which," "was," and "used" were next written and treated orally in the same way. The final sentence selected for dictation was "*Once upon a time a father went to a house which was used by three bears.*"

Thus seventeen of the words from the list were written and used in the first lesson, some of them more than once.

The second lesson by the indirect method was given next day at the same time. Fourteen words from the list were written and used, six of them for the first time. The final sentences selected for dictation were:

1. *When will you knock at the house.*
2. *Which boy caught a canary.*
3. *I know a boy who was killed in a fight.*
4. *Knock him down and come here.*

The words italicized are, as usual, words from the list, several of them, it will be noted, have been used before.

A third and fourth lesson were given in a similar manner. In all these lessons the art of the teacher consisted in choosing words from the list that could readily be used together, and in pointing out peculiarities in the written words: for example, he would show that in "knock" the "k" is not sounded, in "know" that the "k" and "w" are not sounded, and that in "killed" the "d" sound at the end is spelled "ed." But no "direct" spelling was done either by the teacher or by the boys.

On the same days and at the same time of day the other of the two parallel, highly-correlated and equal groups was taught the words from the list by a "direct" method.

The forty words were written in script characters on separate sheets of cartridge paper (11 in. by 15 in.) with black crayon. Each boy was provided with a pencil and sheet of paper on which to write the words. The first sheet was exposed in such a way that all the boys could see the written word. The word was then, letter by letter, spelt slowly by the teacher, and pronounced without syllabification. The boys then spelt the word and pronounced it silently, as many times as they could before the sheet was removed. The method was supposed to be visual and silent, but in actual practice there was some amount of muttering. After 20 seconds the word was withdrawn and the boys wrote it as quickly as they could on their papers. Twenty seconds were allowed for writing and then the next sheet was exposed. A few seconds were lost here and there in recovering the attention of the boys, so that only 38 words were dealt with in the first lesson; it is quite possible that the lesson was somewhat too long.

On the second day 40 words were dealt with, in the third lesson 40 words were dealt with, and in the last lesson 45.

After a lapse of four days both groups were tested together. They were tested in cursive dictation in which the "list" words were embodied. The following were the sentences dictated: the "list" words are in italics,

1. *I saw a boy who said his mother gave him some sweets.*
2. *My father once upon a time went with me and caught and killed a little bird.*
3. *You come to me and see me pick up the bird he threw down.*
4. *The boy was sitting at home in the house.*

Twenty-seven of the "list" words are to be found in the above sentences. The time of the lesson, 30 minutes, having expired, the completion of the test was postponed until the following day. The sentences then dictated were:

1. *Give me the apple which I bought and you are eating.*
2. *I have played the game.*
3. *You knock the ball and I catch it.*
4. *I know he used to buy cakes.*
5. *When did he fight.*

In the preliminary tests the average mark for the pupils of Group A (taught indirectly) was 17.2, that for Group B (taught directly) was 17.8. The correlation coefficient, worked out

from the individual cases, is practically perfect, but there is a slight advantage on the side of Group B in the preliminaries which is several times greater than the probable error of the difference between the means. There is therefore, a general advantage, though slight, on the side of Group B. In the final tests—those in cursive dictation, in which the list words were included—there is a great advantage on the side of the directly taught group, though not found in the highest section of it. The average mark for Group A (taught indirectly) was 26.2 and for Group B (taught directly) was 29.9. The correlation-coefficient, worked out from the individual cases of Group A and Group B on the Pearson “*r*” formula, is + .875, and the probable error of the difference between the means is .71, the difference itself being 3.7, more than 5 times its probable error. Tested by cursive dictation then, the “direct” method has gained a victory over the “indirect” one, though the boys made a great advance by *both* methods, and we must remember that Group B had a slight but general advantage to start with.

In cursive dictation then, the “direct” method wins. But it is sometimes argued that, in original composition an “indirect” method produces better results in the spellings involved in composition, though in dictation it may not. This hypothesis is not very easy to test statistically, but it can be attempted.

TABLE I

Showing, section by section, the number of list words used, and the number spelt correctly in four preliminary and in four final tests in original composition, each word being counted as many times as it was used

No. of Marks in Preliminary Test of List Words	Group A (taught indirectly)					Group B (taught directly)				
	No. of boys	Prel. Tests		Final Tests		No. of boys	Prel. Tests		Final Tests	
		Av. times words used	Av. times corr. spelt	Av. times words used	Av. times corr. spelt		Av. times words used	Av. times corr. spelt	Av. times words used	Av. times corr. spelt
30 and over	4	25.3	23.3	36.0	36.0	4	22.0	19.3	24.7	24.7
25 to 30	4	31.8	23.3	32.5	28.0	4	32.5	26.8	31.0	30.0
15 to 25	5	35.2	21.8	34.2	27.8	5	29.8	19.4	43.6	41.4
10 to 15	3	25.0	14.7	18.3	16.6	3	27.3	15.0	31.3	24.6
0 to 10	5	22.0	12.2	28.0	19.2	5	9.4	5.0	16.0	12.0

Four exercises were given in half-hour lessons as before in which the boys were required to write a story containing some given words. These four exercises were examined, and lists were made showing how often the forty words which had been taught were used in an appropriate sense, and how often they were spelt correctly—a laborious but strictly necessary procedure.

Generally speaking, the boys taught directly won a decisive victory. Whereas, on an average in the preliminary tests, the boys of the “indirect” group used the list words 28.2 times, and spelt them correctly 18.9 times, whilst the boys of the “direct” group used them 23.7 times and spelt them correctly 16.6 times, in the final tests the figures are for Group A—the “indirect” group—30.2 with an average accuracy of 25.2 (83.6 per cent.), and for Group B—the direct group—29.5, with an average accuracy of 26.8 (90.8 per cent.). Not only are the boys of Group B much more correct in the finals—they were somewhat more correct in the preliminaries—but they have made a much greater gain than Group A in the freedom (only appropriate usage counts, be it remembered) with which they use the words in their own composition; for, whereas in the final tests in composition Group A has used the words on an average of 2 per boy in excess of their use in the preliminary tests, Group B has a corresponding figure of 5.8. A second tabulation of the final results was made, in which those list words which were sometimes right and sometimes wrong were rejected altogether, and list words used more than once were counted only once. The boys of Group B proved to be more accurate than those of Group A—they had, indeed, an average accuracy of 89.6 per cent. as against 83.8 per cent. in Group A.

Conclusions

1. Words taught by a “direct” method are remembered more accurately than those taught by an “indirect” method when tested by cursive dictation in which these words occur.
2. There is a greater gain in the freedom of appropriate usage and accuracy in original composition from a “direct” than from an “indirect” method of teaching spelling.

THE THIRD EXPERIMENT

This experiment was carried out with the whole of a Standard III class of about 50 boys whose average age was 9 years 9 months. The boys had not spelt very well when tested by the Head Master in one of his examinations. During the year they had been taught by the aid of transcription, word-building, and the formation of easy sentences about well-known things.

It was decided to teach 60 words, and in order to be sure that the words were within the usable vocabulary of the boys, they were selected, as in Experiment II, from four pieces of original composition, written by the boys without assistance.

The errors in spelling were marked from the whole of the of the composition exercises, and were tabulated in the way already explained in Experiment II. The following words were selected as being those most frequently misspelt.

field	friend	received	enjoyed	said
shining	bought	motor	brought	because
want	sweating	until	policeman	searching
pennies	scrambled	remembered	ourselves	cousin
cricket	traffic	allowed	straight	brooch
biscuit	earned	didn't	knocked	bathe
bicycle	riding	hospital	enemy	chocolate
asphalt	whale	passed	through	arrived
session	whipped	examined	business	pail
surprised	struggling	piece	quite	Montagu St.
really	sword	medicine	service	bullets
climbing	drowned	caught	operation	carried

The selected words were dictated to the boys as a list. The Assistant Master called out a word, and the Head Master placed it in a short sentence orally. Then the boys wrote down the word. The class was then divided into two parallel and equal groups on the basis of the results.

The Head Master who taught one of the groups used a "direct method." In the first lesson he gave out orally the first word from the list, and called upon a boy to spell it. If the first boy failed, another boy tried. When the word was spelt correctly, it was written by the master in crayon on a large sheet of cart-ridge paper, and shown to the class. The Master then spelt and pronounced the word once, without syllabification, and the boys, looking at the sheet, spelt and pronounced the word twice. The work was rapidly done, since 52 of the words were spelt in the first lesson. In the second direct lesson an identical method

was adopted for the eight list words remaining, and after those words had been dealt with, the lesson became recapitulatory, the boys being called upon to spell individually, after and not before the word on the sheet had been spelt and pronounced by the master once, and twice by the boys collectively. In the third direct lesson, the boys spelt silently through the words exposed, one by one, for seven seconds, on the sheets previously mentioned and after the exposure wrote them quickly, one by one, on paper.

The Assistant Master, who taught the other group, used an "indirect method," almost identical with that used by him in *Experiment II*. I shall describe the first lesson only and merely indicate the others. The words "field" and "shining," selected from the list, were written on the blackboard, and the boys were asked to give orally, sentences containing these words. Then the words "bought" and "pennies" were treated similarly. The boys were now permitted to write down on a paper sentences containing these words. They were instructed to write either sentences which they had thought of for themselves, or which they had heard given orally. All four words could be placed in one sentence, and a few boys managed to do this successfully. Other words dealt with in the first lesson were: (2) hospital, piece, asphalt, traffic; (3) policeman, knocked, really, received; (4) bicycle, business, bought, brooch; (5) until, biscuit, enjoyed, because.

In the second and third lessons by an indirect method, a similar procedure was adopted with the remaining words. In all the lessons, as the words were written on the board, the teacher called attention to orthographical peculiarities. With "field" and "friend," and "received," he pointed out the rule about "ie" and "e"; in "shining" and "riding" that the "e" in "shine" and "ride" was omitted; in "went" that no "h" was used; in "pennies," that the "y" of penny was changed into "ies"; in "biscuit" and "bicycle" that the parts "bis" and "bi" meant two or twice; in "asphalt" that "ph" was sounded like "f"; in "surprise" that the word was sur-prise, not supprise; in "climbing" that the "b" was silent; in "shipped" that there were two "p's"; in "sword" that the "w" was not sounded; in "drowned" that the word was not drown-ded; in "until" that there was one "l" only; in "ourselves" that the word did not

end in "selfs"; in "knocked" that the "k" was silent, in "business" that the word was made up from "busy" and "ness"; in "brooch" that the "oo" sound was unusual; in "bathe" that there was an "e" at the end; in "carried" that the "y" of carry was changed into "i"; and in "passed" and "pail" distinctions of meaning were made between them and "past" and "pale."

The words which had been taught were dictated as a list, and the papers marked and tabulated. Then four exercises were given in original composition, similar to those which had been given for the preliminary exercises.

All the list words occurring in the boys' composition exercises were marked and tabulated, each word being counted as many times as it was used. As apparently the boys taught directly had again been victorious, the Assistant Master argued that, though the boys thus taught were better spellers immediately after teaching, nevertheless, his method produced the more enduring results. To test this issue, the list words were dictated again two months later.

The average mark for Group A (indirect) in the preliminary test was 39.2, and for Group B (direct) was 39.2. The correlation-coefficient, worked out from the individual cases of A and B was + .99; the difference between the means was .1, and the probable error of that difference was .15.

The average mark for Group A in the first final test was 49.1, for Group B was 57.3. The correlation-coefficient was + .51; the difference between the means was 8.2, and the "p. e." of the difference was 1.1.

The average mark for Group A in the second final test, two months afterwards, was 47.9 and for Group B 55.2. The correlation-coefficient was .70; the difference between the means was 6.3, and the "p. e." of that difference was .80. The groups were extremely well-balanced for a start, for we left out two or three boys who would not pair; and, though a few boys left during the experiment, we crossed out the corresponding boys in the other group, and so maintained an exact balance in the preliminary test in spelling. The result is a clear one, and shows a decisive victory for the directly taught group all along the line.

Another tabulation of the results showed that the gain both in freedom of usage and accuracy was greater on the part of the directly taught group than of that taught indirectly. Group

A used the words an average of 22.8 times with an average of 21.1 spelt accurately in the preliminary exercises, whilst Group B has corresponding figures of 27.6 and 25.5. The comparative accuracy is 92.3 as against 92.6 per cent. In the final exercises Group A used the list words 28.9 times on an average, with an accuracy of 27.7; whilst Group B has corresponding figures of 34.9 and 33.8. The comparative accuracy is 95.8 as against 96.7 per cent.

THE FOURTH EXPERIMENT

This class consisted of boys who were new to the school; their average age was 6 years, 11 months on March 31, at which date they had been sent forward from the Infants' school to the Senior boys' school. They were promoted from three classes in the infants' school, and were of varying educational attainments; but all of them could read a little and some of them could read quite well. Their teaching had been conducted on a "phonic" method, and most of them knew the "sounds" indicated by the literal symbols, but they had not been taught the alphabetic names.

It is commonly found in English infants' schools taught by a phonic method which does not use the alphabetic names of the letters that the children do, nevertheless, acquire the names, or some of them, at home or from other school children; and this was, to some extent, true here also, but not to the same extent, for there was practically no English reading in their homes, and their parents were foreigners. In the infants' school they had learned to copy words from the blackboard, writing on paper with pencils, but they had never written either words or letters from dictation, nor had they written with ink. As the scheme of work (each school makes its own syllabus in England) in the school requires from the boys of this "standard" (grade) at the end of the first half-yearly term, the writing from dictation of some five lines of printed matter, and also of some ten to fifteen lines of English composition, it was obvious that some way of combining writing with spelling was necessary.

It was thought that a very comprehensive test might be made if forty common words were dictated, selected from the exercises in original composition of a previous Standard I class in the same school. The results were not encouraging, the average number

of words correctly spelt was only 4.4 out of 40. It seemed rather doubtful whether two equal and parallel groups could be satisfactorily made from such poor material, but the attempt was made and proved successful.

The Head Master favored a direct method, the Assistant advocated an indirect method, and both of them thought, having regard to the relative inexperience of the boys in writing down words from memory, that a writing factor should be involved in both methods. The forty words by means of which the division into Group A and Group B had been effected were taught to both groups at the same time of day. The Head Master had written his words in script characters, one by one, on large sheets of paper. They were exposed one at a time, for 20 seconds each, spelt and pronounced by the Master without syllabification, then spelt visually (with some articulation) by the boys, and written from memory on paper. This procedure was adopted in all four of the Head Master's lessons, and the words were, in all, dealt with three times each. The Assistant Master taught by an indirect method which I have already described. He selected first one word, then another, and then another, writing the words on the black-board, and asking for oral sentences containing them. Finally he dictated the best sentence given.

On the following day at the usual time in the afternoon all the boys of this class were tested by the dictation of words. The Head Master called out the words thus, placing each one in a sentence; "'Pick,' pick up your pen, write 'pick,'" and the boys wrote down the words with ink.

Group A (indirect) began with an average of 4.5, and finished with an average of 9.4; Group B (direct) began with an average of 4.2 and finished with an average of 11.7; the correlation coefficient, worked out from the individual cases of Group A and Group B, in the preliminary test is + .98, the difference between the means is .3, and the "p. e." of the difference is .19, more than half that difference; the correlation coefficient in the final test is + .95, the difference between the means is 2.2, and its "p. e." is .5, the difference being more than 4 times its probable error.

THE FIFTH EXPERIMENT

The Head Master, who had taught throughout on a direct method, had come to the conclusion, during the course of his teaching, that the lesson in "direct" teaching had been somewhat too long for the most effective attention to operate throughout. So he proposed to try again with a fresh class, comparing the results of a direct with those of an indirect method as before; but instead of giving lessons of equal length by the direct and indirect methods, he now thought of shortening the time allotted to the direct method by giving just half the time in each lesson to that allotted to the indirect method.

The Head Master taught one group in the following manner. The 60 selected words had been written beforehand, one by one, on separate sheets in script characters. Exposing a sheet the Master spelt and pronounced the word once, with a slight pause at the syllables. The boys then spelt aloud and pronounced the word twice, also with a slight pause at the syllables. Thus the lesson proceeded for 10 minutes. Two more lessons were given on succeeding days. During the three lessons of 10 minutes each the 60 words were spelt through twice.

The Assistant Master conducted three lessons by his indirect method on the same days, commencing at the same time, but each of his lessons lasted 20 minutes. In the preliminary tests the boys of Group A (indirect) scored an average of 34.2; Group B (direct) scored an average of 34.1; the difference between the means is .1, the correlation coefficient between the two series A and B is + .99, and the "p. e." of the difference is .2. In the final tests Group A scored 44.8, Group B 50.7; the correlation coefficient is + .78; the difference between the means is 5.9, and its "p. e." is .8, less than one-seventh of that difference. The advantage is clearly with the direct method.

THE SIXTH EXPERIMENT

The school chosen for this experiment was a girls' school situated in a fairly good neighborhood in a London suburb attended by children of good ability. The whole of the teaching relative to the experiment was in this case carried out by the Head Teacher, who had a personal leaning toward the indirect rather than the direct method. The general plan of the experiment was the same as in those previously recounted, and involved

the whole Standard III class of about 50 children whose average age was 9 years 5 months. A passage was dictated, and on the basis of the results the girls were divided into two parallel and equal groups.

In the first lesson given in an indirect method, twenty words were dealt with in the twenty minutes. The word "Tuesday" was written on the blackboard; the girls were asked what was difficult in the spelling of this word, and they answered "ue." They were then requested to give a sentence orally containing the word "Tuesday." The word "excursion" was next written, and the children warned to write "sion" not "tion." Oral sentences were asked for containing this word. Then the word "country" was dealt with. Some of the girls pointed out that the "o" was not sounded. Then the word "aunt" was taken, and the girls said "u" in this word had the sound of "r." Sentences were asked for containing both the last words, and then sentences containing all four words. Of those given the following was selected and rapidly dictated: "I went on Tuesday for an excursion into the country with my aunt." In the second lesson the remaining twenty words were treated in a similar manner, and the third lesson, since all the words had been studied in lessons one and two, dealt with the twenty words of greatest difficulty.

In the direct lessons the procedure was as follows. The 40 words were written on 40 separate sheets of cartridge paper in large text script. Each word was exposed for 28 seconds. The teacher spelt the word slowly and distinctly, making a slight pause at the syllables, and then pronounced the word. The girls learnt by a visual silent method, and there was little, if any, audible articulation. All the words were dealt with in the first lesson. In the second lesson the teacher began at the end of the list, and in the third at the middle of the list, the 20th first, then the 21st, then the 19th, then the 22d, and so on.

The preliminary test was given to some 50 girls. Of these two could not be "paired," one girl having 39 words right and one having 3 only. In the results of the final test there were some suspicious figures. Three or four of the girls had made extraordinary improvement and they were questioned as to the working at the words out of school hours. Three of them were found to have done so, and they, and of course the girls "paired"

with them in the opposite group, were omitted. One other girl, liking the lesson, had managed to come in, on one occasion, to both the "direct" and "indirect" teaching; she and the girl paired with her were, of course, excluded.

Owing to excisions, the indirect group was slightly better in the preliminary test. Group A (indirect) scored an average of 25.5, against 25.3 for Group B (direct), the correlation-coefficient was + .998, the probable error of the difference between the means was .08, and the difference itself was .2, between 2 and 3 times as great as the probable error. Thus we are justified in saying that Group A was the stronger group originally.

In the final test the positions were reversed. Group A scored an average of 33.7. The correlation-coefficient is + .847, the difference between the means is 1.9, and its "p. e." is .5, about one-fourth of that difference. The average age of the two groups was identical.

THE SEVENTH EXPERIMENT

It remained to be seen whether similar or different results would be obtained with a higher class in the same girls' school; and whether the adoption of a test involving rather more literary expression and containing words which were not so fully within the usable vocabulary of the children would produce a variation in the results.

The experiment was carried out with the whole of a class (Standards V and VI) of 56 girls whose average age was 11 years, 9 months.

The test consisted of a dictation exercise given out in three sections, (a), (b) and (c). The experimenter read the first section, and then dictated it, phrase by phrase. Then the second section was read and dictated in the same way; and finally, the third. Forty-five words were selected for subsequent teaching. The final test was the same as the preliminary, and was administered in the same way.

On the results of the preliminary test the girls were divided into two equal and parallel groups. All the teaching and testing was done by the Head Mistress, who had had years of experience in experimental work with school children. The "indirect" lessons were given as follows: In the first lesson, the words *cathedral*, *eminence*, *situated*, and *centre* were written on the black-

board, and the children were asked for meanings (where necessary) and for comments on the difficulties involved in the correct spelling of the words. In the case of cathedral, a girl suggested that the "c" might be changed into "k." The meaning of *eminence* was explained, and it was pointed out that the termination was "ence" not "ance." No comment was made in *situated*; but in considering the word *centre* it was pointed out that in England the termination of the word was "re," and not, as might have been expected, "er." Oral sentences were asked for containing all four words and the following sentence, given by one of the girls, was rapidly dictated.

"The eminence upon which the cathedral was situated was in the centre of the town."

So the lesson proceeded with words written on the blackboard, comments, oral sentences, and sentences dictated. The second lesson was identical in method with the first. At the conclusion of the second lesson, as there was a little time to spare, the words *jealously*, *clangour*, *machinery* and *precincts* were dealt with a second time.

The direct lessons were given as follows: The words were written on separate sheets of cartridge paper, and exposed, one by one, to the class. The teacher spelt the word slowly and distinctly, with a slight pause at the syllables, and then pronounced it. The children learnt the word silently and visually. Each exposure lasted about 26 seconds. All the words were dealt with in the first lesson, and again, in exactly the same way, in the second lesson. We started with 56 girls, but four could not be "paired," and two were away on the day of the final test, so that the girls "paired" with them had necessarily to be excluded also, thus leaving 48 cases for final tabulation. The absences threw the preliminary balance of the groups out a little since the "paired" children were not individually quite equal. The average preliminary score was, for Group A, 30.8, and for Group B, 30.5. The correlation-coefficient, worked out from the individual cases of the two groups, was + .984; the difference between the means was .3, and the "p. e." of this difference was .14. Thus the balance was in favor of Group A in the preliminary tests.

In the final tests the balance of advantage shifted to the other side. The average score for Group A was 37.9, and for

Group B, 39.0; the coefficient of correlation was $+ .59$; the difference between the means was 1.1, and the "p. e." of this difference was .51.

Thus a difference of twice its probable error in favor of Group A in the preliminary tests has been transferred to Group B in the final tests.

THE EIGHTH EXPERIMENT

This experiment was carried out with the whole of a class numbering 54, of Standard IV children (girls) whose average age was 10 years, 6 months. The test consisted of 50 difficult words embodied in continuous prose. The passage was dictated in three paragraphs, the first paragraph being read and then dictated phrase by phrase, then the second and the third. The girls' papers were marked on the results of the test and two equal and parallel groups were formed.

All the teaching was done by the same teacher, namely, the Head Mistress, who was a skilled experimenter with a leaning towards an "indirect" method. The preliminary test was given to 54 girls; but 4 of them would not "pair," so that 25 only were placed in each group. We were fortunate in having no "absentees" throughout the experiment, so that the results of all the 50 children were available for tabulation.

The average preliminary score was, for Group A (indirect) 23.8, and for Group B (direct), 23.8. The correlation-coefficient, worked out between the individual cases of Group A and Group B, was $+ .99$, and the "p. e." of the difference between the means was .05.

In the final test Group A (indirect) scored 37.4, whilst Group B (direct) scored 44.5. The correlation-coefficient between the A series and the B series was $+ .65$, the difference between the means was 7.1, and its "p. e." was .87, one-eighth of that difference.

The average age of Group A was 10 years, 6.5 months, and of Group B was 10 years, 7 months.

SUMMARIZED CONCLUSIONS FROM THE EIGHT EXPERIMENTS

1. In eight different classes, ordinarily taught by eight different teachers in two schools of different sex and social type, a "direct" method of teaching spelling has proved superior to an "indirect" one.

2. Words learnt by a direct method which can be written correctly in lists can also be written correctly among others in cursive dictation or original composition.

3. It appears from the second and third experiments that there is a greater gain in the freedom of appropriate usage in original composition from a "direct" than from an "indirect" method.

4. It appears from the fifth experiment that lessons by a "direct" method may be shorter than those by an "indirect" method, and yet be more profitable.

5. It appears from the fourth experiment that the balance of advantage, even after the lapse of two months, is still markedly in favor of the "direct" method.

COMMUNICATIONS AND DISCUSSIONS

REPORT OF THE TWENTY-FOURTH ANNUAL MEETING OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION, CHICAGO, DECEMBER 28-30, 1915.

The program of the Twenty-fourth Annual Meeting of the American Psychological Association comprised some seventy addresses, ranging all the way from psychology in its relation to philosophy to psychology in its applied aspects. Parallel sessions were held throughout most of the program and the notes here given are drawn from those only which the writer attended and are further limited to those considered of special interest to educational psychologists. The address of the President, John B. Watson, upon "The Place of the Conditioned Reflex in Psychology," and many other addresses equally profound and inspiring to the general worker in psychology are not included.

Several papers emphasized the growing interest in tests for determining vocational fitness. F. Lyman Wells and Walter Dill Scott brought out the importance of comparing the experimental status of a group or of individuals with their later careers. Scott proposed, in his paper upon "Experiments on Vocational Selection," two means of checking up test results: (1) by testing employees whose ability is known to the employers, and, (2) as mentioned above, by examining applicants and correlating their standing in tests with success after employment. Correlations as high as .90 were obtained by use of the former method.

Mental age tests and problems concerning the feeble-minded occupied a large part of the program. Augusta F. Bronner made very clear a point too little recognized, that attitude materially affects performance on tests. Much may be revealed by a child who wilfully fails in a test, but obviously the revelation is not that of feeble-mindedness. Criteria of dissimulation are much needed in practical mental diagnoses.

J. B. Miner proposed a "Percentile Definition of Intellectual Deficiency." To call the least intellectual $\frac{1}{2}$ (or some other) per cent. of the population "feeble-minded" has the decided advantage of giving an objectivity to the term "feeble-minded" that the usual definitions

in terms of economic and social self sufficiency, or in terms of years of retardation, do not give. The number of years retardation before an individual may be proclaimed feeble-minded varies with age, as does also the value of the intelligence quotient proposed by Stern. It is reasonable to believe that the percentage definition would not be subject to this objection. It is also a definition that would be readily comprehended by the layman.

The percentile method of locating the standing of children was used to very excellent advantage by Helen Thompson Woolley and Charlotte Rust Fischer in their study of the "Comparative Rank in Mental and Physical Tests of 14 and 15 year-old Working Children with 14 and 15 year-old School Children." The most striking of the results shown was that the school group stood above the working group in all tests, physical as well as intellectual.

J. E. Wallace Wallin, in his paper upon "Who is Feeble-Minded," criticized the acceptance of failure to pass Binet age 12 as evidence of feeble-mindedness, showing that many successful housewives and farmers do not rank up to that age. Wallin suggested Binet age 9 as a reasonable limit. The discussion showed the existence of quite general opposition to accepting Binet age 12 as the lower limit of normality.

Joseph W. Hayes' study comparing the "Binet-Simon Method of Measuring Intelligence with the Yerkes-Bridges Point Scale Method," showed that in the earlier years the Binet results fitted more closely to the chronological ages of normal children than the Yerkes-Bridges results and that from eight or nine on, the Yerkes-Bridges method gave the better results, the disagreement being quite plainly due to to the difference in methods of scoring and not to differences in test questions.

Samuel G. Kohs considered "The Distribution of the Feeble-Minded Arranged by Mental Age (Binet)," and gave as the result of his calculations the estimate that about 54% of the feeble-minded are at large, about 30% in institutions for the feeble-minded and about 15% in penal institutions.

Karl T. Waugh gave some results of "Mental Tests of College Students as Freshmen and as Seniors." The improvement in attention (cancellation test) of the college seniors over their standing as freshmen was 4.6%; in speed of learning 4.2%; in association 2%; in range of information 44.7%; in class standing 19%. These results are highly suggestive of the kind of traits influenced by a college education.

Rudolf Pintner reported progress in standardizing some 15 performance tests, which are independent of language. A scale of such tests will be very serviceable in examining non-English-speaking individuals, or those of poor language endowment. The tests thus far standardized are: Feature Profile, Manikin, Five Figure Board, Two Figure Board, Casuist Form Board, Seguin Form Board, Adaptation Board, and Healy's Five Block Frame Test.

Daniel Starch presented "A Scale for Measuring Ability in Arithmetic." This consists of twelve problems, scaled for difficulty upon the basis of percentage of pupils who passed them. The distributions for grades four to eight are very much like the distributions in other traits which have been measured. Decided overlapping from grade to grade was shown. Approximately 33% of any grade reach or exceed the median of the grade above. An unusually strong sex difference was revealed—approximately 60% of the boys reaching or exceeding the median of the girls.

The exhibit and description of laboratory material held several features of educational significance. Truman Lee Kelley presented a test of initiative (described in the January number of this JOURNAL). W. V. Bingham presented a learning test and two spatial relations tests. The latter are tests demanding the kind of talent a mechanic must have in reading working drawings, or in interpreting two-dimensional data into three-dimensional facts. Such a test should prove of value in determining vocational fitness. C. L. Hull presented an exposure apparatus used in "A Quantitative Method of Investigating the Evolution of Concepts." The experiment described gives a means of noting the mental stages in the dropping out of irrelevant material as a concept of an element common to many situations is gradually built up from repeated experience with the various situations in which it is found.

Joseph Jastrow contributed to "The Study of Judgments" in showing that reliable aesthetic, moral and other judgments may be obtained from the consensus of opinion of a jury of a certain size. For example, the offensiveness of grammatical errors, slang expressions, etc., may be measured, for it was shown that judgments of these things are by no means random.

Herbert Woodrow and Frances Lowell have extended the use of the Kent-Rosanoff association list and methods, by drawing up "A Childrens' Association-Frequency Table." Unfortunately the method was not that of oral reaction, but the results strongly suggest, if

indeed they do not prove, very material differences between children and adults in types of association.

In a rather taxing learning experiment, involving motor co-ordination, which largely eliminated the factors of experience and environment, W. H. Pyle showed that 92% of white children exceed the negro average. It appears that negro children have from $\frac{3}{4}$ to $\frac{4}{5}$ the learning capacity of white children.

An analysis of typewriting habits shows that certain letter combinations are much more frequent in ordinary usage than others. Working with a group along this line M. E. Haggerty reported that typewriting practice of these most needed combinations of letters resulted in much more rapid improvement than that resulting from the usual procedure.

Frank M. Freeman and C. T. Gray reported intensive studies of handwriting and reading respectively. The use of moving pictures and of a hand-tracer in making possible the study at leisure of the rapid motions and the fine adjustments in writing and the use of a two-lensed camera, operated synchronously with a phonograph, to record the eye movements, vocal adjustments and time elements in reading, give promise of enabling an analysis that will show the motor correlates of good and poor reading as well as suggesting the psychological concomitants.

The following resolution, introduced by G. M. Whipple and of interest to all engaged in mental testing, was passed at the business session:

"Whereas psychological diagnosis requires thorough technical training in all phases of mental testing, thorough acquaintance with the facts of mental development and with the various degrees of mental retardation, and, whereas there is evident a tendency to appoint for this kind of work persons whose training in clinical psychology and acquaintance with genetic and educational psychology are inadequate, be it resolved: That this association discourage the use of mental tests for practical psychological diagnosis by individuals unqualified for this work."

The very excellent report of the committee on the Academic Status of Psychology, covering "The Academic Status of Psychology in the Normal Schools," was submitted in printed form. This report supplements that of the same committee last year upon the status of psychology in colleges and universities. It gives information con-

cerning the training of instructors in psychology and the methods of teaching this subject in normal schools.

The addresses upon "The Relation of Psychology and Pedagogy" raised issues confronting every growing department of education. M. E. Haggerty presented a course of study offered by the University of Indiana and particularly recommended it as a preparation for advanced research work in education. It included elementary, experimental, educational and other courses in psychology. C. H. Judd dealt particularly with courses in education for the prospective teacher. One fundamental thesis laid down was that general psychology has failed to give a scientific background for scientific activities in school practice. The reasons for this are: (1) Psychology does not deal with those problems that must be faced by the teacher. General psychology is too broad—unless application of psychological principles to educational situations is made by the teacher, it is not made. There is a great difference between courses that are applied to education and courses in which it is hoped students will make the application. Students do not and can not make the applications. (2) The beginning education student needs, in the first course, to be made aware of the problems of education and to be given specific facts which will contribute to the solving of those problems. (3) The disputes within psychology itself draw the attention of prospective teachers away from its educationally valuable and discovered facts. Judd apparently agrees with Haggerty in the value of general psychology for the leaders in educational science, but proposes "educational psychology," or perhaps better "experimental education" for the rank and file of teachers.

TRUMAN LEE KELLEY.

University of Texas.

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EDITORIAL

It is a healthy indication that the subject matter taught in our schools is being subjected to an increasingly critical scrutiny. It is only recently that we have begun to realize the extent to which our curricula depend on tradition, and to consider whether the traditional subjects are the best possible ones for the development of boys and girls to take their places in a modern social world. The opinion has been frequently expressed in these columns that there are fundamental lines of education that should find a place in every course of study. These are English, the natural sciences, the social sciences, and art. All of these are relatively modern in their appearance in school curricula, and the social sciences have been among the most recent. There is a growing conviction on the part of school administrators and others interested in the development of schools that not enough attention is being paid to the social world in which we live. The phenomena of society are just as detailed and specific as are those of the natural world, and, in the opinion of many, are of even greater importance for the successful conduct of practical affairs.

There are many problems in the teaching of the social sciences that call for investigation. To begin with the elementary school, how much time should be devoted to the study of history in the different grades, and what should be the nature of the history work in each of these grades? Anyone who has had much to do with young children knows how eager they are for stories, and many of the more dramatic incidents of history can be taught even in the kindergarten. The efforts of the Herbartians to construct a school program on the basis of the theory of recapitulation had at least the merit of emphasizing social relationships, and inculcating a thorough understanding of the development of social activities. It is undoubtedly a mistake to attempt to teach fourth grade children the philosophical significance of the French Revolution, but the dramatic events of that period will be seized upon and worked over with great avidity by pupils of that age. Most elementary schools now provide for a certain amount of local and national history, but it is a question whether large world movements might not profitably be opened up at some point in the elementary course. Many of the reforms in the teaching of geography have aimed to place a greater emphasis on the social results of man's relation to the earth, but there is little danger that this point of view will be over-emphasized.

In the high schools much has been done in the past twenty-five years to provide an opportunity for a thorough and extensive study of history. Unfortunately, however, much of the history teaching is of the static, cross-section type, and there is a generally recognized need for a greater socialization of the history work. Moreover, it is difficult to see why certain phases of economics and sociology and even of psychology might not be taught to high school pupils with much greater profit than is realized from the traditional work in mathematics and languages. The types of courses in these subjects that are best adapted to stimulate the thinking of boys and girls of high school age are still matters to be worked out. Modern physiology, while primarily a natural science, is quite properly presented in the high school with strong leanings to social hygiene, and thus partakes of the nature of a social science. With the keenly awakened and rapidly developing sense of social values in the community at large there is certainly need for greater attention to the amount of time devoted to the social sciences in our courses of study and to the way in which these subjects may be most advantageously presented.

J. C. B.

NOTES AND NEWS

At the University of Iowa Professor Carl E. Seashore is developing a series of tests to facilitate the discovery of musical talent in the public schools. While most of these tests must be made upon a single individual at a time and with accurate instruments, many of them may be made in a large class room with fifty, a hundred, or even five hundred students at a time. The plan is to use the class room tests for preliminary findings and then employ the finer individual tests upon the few most interesting and significant cases which are caught in this first drag-net. Among the class tests are quantitative measurements on the ability to hear pitch, tonal memory, the sense of consonance, tonal imagery, and the time sense. These are fundamental and are quite certain to reveal the presence of unusual talent or conspicuous absence of talent. At the present time such measurements are being made on a class of three hundred university students, for each of which a musical talent chart will be made out, and cases of special interest may be investigated in greater detail. During the second half year it is planned to continue on a large scale the measurement of children of the various grades in the public schools of Iowa.

In the Horace Mann Elementary School, New York City, extensive use has been made during the past year of standard scales in school subjects to establish norms of improvement in the work of the grades. The Courtis Standard Tests in Arithmetic were used both at the beginning and at the end of a period of intensive drill on the fundamental operations. Marked improvement was noted in each grade although the pupils failed to reach the Courtis standards. Norms were also established in spelling by the use of the new Ayres spelling scale, in composition by the Hillegas scale and in reading by the Thorndike tests. Further details in regard to these norms may be found in the dean's Report, Teacher's College Bulletin, October 23, 1915.

At the University of Indiana Professor H. G. Childs has devised a series of algebra tests arranged on the principle of the time limit, similar to that used in the Courtis tests in arithmetic. There are twelve of these tests, including subtraction (two minutes), multipli-

cation and removal of parentheses (one minute), solving equations involving but one process (one minute), division (six minutes), transposing terms (one minute), collecting terms (two minutes), stating simple problems in the form of equations (four minutes), clearing of fractions (three minutes), solving simple equations (ten minutes), factoring (three minutes), elimination and solving simultaneous linear equations (five minutes), and stating problems in the form of equations (ten minutes). The net working time for the entire series is thus forty-seven minutes. Score cards have been worked out for each test to indicate the number attempted and number right, and the distribution of the results in a given group of pupils.

The National Associated Schools of Scientific Business, Sherwin Cody, Managing Director, a Chicago organization, has issued an interesting booklet entitled *National Business Ability Tests*. The tests include a reliability test, indicating the faithfulness of performance of school tasks on thirty successive school days, an attention test involving the cancellation and otherwise marking of certain digits in a given time, a memory test with department store sales slips as material, the Courtis arithmetic tests, series B, tests in fractions and percentage, elementary and advanced spelling tests from the Ayres lists and other sources, elementary and advanced grammar tests, copying addresses, card filing, mimeograph work, shorthand and typewriting, business papers, and letter writing. The tests give evidence of considerable acumen in their selection and arrangement, and a study of the results of their application to a considerable number of people would be of great interest.

An interesting score card for school buildings and equipment for city elementary and high schools has been devised by Professor Burt W. Loomis, head of the Department of Education, Tarkio College, Missouri. The score card embraces four general rubrics, as follows: (1) site (160 points), (2) general features of plant (285 points), (3) school rooms (400 points), (4) special rooms (155 points), total 1000 points. Each of these rubrics is divided and subdivided, and the number of points for a perfect score is indicated with each sub-head. No explanation is given of the way in which the number of points was assigned to each particular subdivision. The scheme offers an excellent starting point for a comparative study of school buildings and for an experimental determination of the relative values of the different topics.

The St. Louis School of Social Economy under the direction of Dr. George B. Mangold, offers an attractive program of lecture courses for the second semester of the current year. As titles of the courses we note Child Problems, Organization and Functions of Social Agencies, Labor Problems and Social Reforms, the Practice of Organized Charity, Visiting Institutions and Social Agencies, Neighborhood and Group Work, Subnormal and Feeble-Minded Children, and Women and Industries.

An elaborate survey of the educational institutions of the State of Washington was authorized by the last legislature. The survey will be under the immediate direction of F. P. Capen, specialist in higher education in the Federal Bureau of Education. The following prominent educators will be called into conference in the course of the survey: Dr. P. P. Claxton, Federal Commissioner of Education, President Hill of the University of Missouri, President Pearson of Iowa State College, and President Seerley of the Iowa Normal School. The survey will be concerned particularly with the financial aspects of education, but will also investigate such problems as the entrance requirements of the high schools, the segregation of boys and girls in the high schools, and the extension of vocational training courses.

Under the supervision of Dr. David Spence Hill, Director of the Division of Educational Research, all the elementary school pupils of New Orleans have been given the Ayres Spelling Test as originally used in Springfield, Illinois. The results of the test, including papers from over twenty-five thousand children in seventy-eight different schools, are being tabulated by the graduates of the New Orleans Normal School. The results when completed will constitute one of the most extensive systematic studies of spelling that has yet been undertaken.

We learn from Professor Bingham that the department of psychology in the Carnegie Institute of Technology will add to its staff next September Dr. Kate Gordon, who is at present head of the department of education in the Bryn Mawr graduate school. Dr. Gordon will teach educational psychology in the Woman's Vocational School and esthetics in the School of Applied Design. She will also co-operate with the Bureau of Mental Tests in its task of helping the students to choose their courses wisely.

Arthur J. Jones (Ph. D. Teachers College, Columbia), Professor of Education at the University of Pennsylvania, is organizing a department in the History of Education at Swarthmore College. Since the new department of Psychology and Education was organized at the College, over a hundred students have completed the professional requirements of 18 college hours or more with from six to twelve weeks of practice teaching in the high schools of the community.

During the spring semester and summer session of this year, Professor E. P. Cubberley, of Stanford University, will give courses in school administration at Teachers College, Columbia University. Professor Lewis M. Terman will be acting head of the department of education at Stanford during his absence.

Dr. J. K. Hart, for a number of years a member of the department of education at the University of Washington, who is taking a year's leave of absence, has decided to teach a rural school for the year for the purpose of studying at first hand the problems of the rural school.—*School and Society*.

Dr. John W. Todd, of the University of North Dakota, has been given a leave of absence to act as head of the department of psychology at the University of Indiana. Professor John Winter, of Goshen College, takes Dr. Todd's work at North Dakota.—*School and Society*.

Dean Lotus D. Coffman, of the college of education of the University of Minnesota, has been engaged by the General Education Board to make a survey of the facilities for the training of rural teachers.—*School and Society*.

Dr. B. R. Buckingham, chief statistician of the Board of Education, New York City, well known for his study of "Spelling Abilities," has accepted the position of chief statistician to the new Wisconsin State Board of Education.

A CORRECTION

The Managing Editor wishes to call attention to an error of the compositor in Mrs. Edwina Abbott Cowan's article "An Experiment on the Influence of Training on Memory" in the January number of this JOURNAL. On pages 37 and 38 in both Table II and Table III the subjects on the left hand side of the table should have been marked "Trained Subjects," while those on the right hand side of the table should have been marked "Untrained Subjects."

PUBLICATIONS RECEIVED

W. S. DEFFENBAUGH. *School Administration in the Smaller Cities.* Bulletin, 1915, No. 44. Washington: Bureau of Education, 1915. Pp. 240.

This bulletin is based upon 1300 replies received to a questionnaire submitted to superintendents in cities having a population of from 2500 to 30,000, and upon material collected through visits to a number of schools in these cities. The discussion of the school board includes such topics as its size, method of selection, length of term, qualifications, committees, providing buildings and grounds, making wider use of the school plant, establishing vacation and evening schools, providing special classes, establishing the length of the school day, and supplying text books. There are chapters on school finances, the functions and tenure of the superintendent, the duties of principals and supervisors, the status of teachers, the health inspector and school nurse, and other employees and officers. Over 100 pages are devoted to statistical tables.

FLOYD CARLTON DOCKERAY. *The Effects of Physical Fatigue on Mental Efficiency.* The Kansas University Science Bulletin, Vol. IX, No. 17, September, 1915. Pp. 197-243.

The tests of mental efficiency employed were four in number—an addition test, a multiplication test, an attention test, utilizing telegraph soundings, and an association test, with nonsense syllables as stimuli. The physical fatigue was produced in various ways, *e. g.* by work with a wall machine in a gymnasium, by running on an indoor track, cross-country running, work with the ergograph, and walking. There is a discussion of the significance and reliability of each of the tests as an indication of mental efficiency and fatigue, and a brief study of the curve of mental work. The author concludes that the effect of physical fatigue upon mental efficiency is very irregular, especially as shown by the addition and multiplication tests. The sounder and association tests present more uniform results. There is a bibliography of fifty numbers.

AURELIO M. ESPINOSA AND CLIFFORD G. ALLEN. *Elementary Spanish Grammar.* Cincinnati: American Book Co., 1914. Pp. 367.

This grammar is constructed on the traditional model with lessons presenting various aspects of grammatical usage, a vocabulary, a bit of text for translation into English, conversational exercises on

this selection, and English sentences which are to be turned into Spanish. There is nothing novel or radical in the way of method, and on that account the book will be found very serviceable by those who believe that a language ought to be approached through the gateway of its grammar. The book contains numerous illustrations and maps.

GERTRUDE E. HALL. *Report upon the Standardization of Eleven Mental Tests*. Bulletin No. 5 of the Eugenics and Social Welfare Series of the New York State Board of Charities. Albany, N. Y., 1915. Pp. 459-545.

The tests referred to are the form board, two construction tests, the making of a paper drinking cup from directions, a tapping test, cancellation of digits, recognition memory, fidelity of report, pictorial completion, telling time, and antonyms. In the form board test Goddard's procedure was used and comparative tables are given, showing the results obtained by previous investigators, and those from the bureau's studies of over a thousand individuals. Both the construction tests follow Healy and Fernald. The tapping test is one used by Healy at the suggestion of Whipple, and the recognition memory, fidelity of report, pictorial completion, and antonyms tests are all after Healy. The scores are tabulated both according to physical age and to mental age as indicated by the Binet scale. Under each test after the presentation of results there is an interesting discussion of the value of the test for mental measurements.

ELLSWORTH HUNTINGTON. *Civilization and Climate*. New Haven: Yale University Press, 1915. Pp. xii, 333. \$2.50.

"This volume is the product of the new science of geography. The old geography strove primarily to produce exact maps of the physical features of the earth's surface; the new goes farther. It adds to the physical maps an almost innumerable series showing the distribution of plants, animals and man and of every phase of the life of these organisms. Among the things to be mapped human character as expressed in civilization is one of the most interesting and one whose distribution needs explanation." The essential thesis of the book is that civilization is largely the product of the stimulation produced by climatic influences. Of these climatic influences probably the most potent in their stimulating effects are wind-storms. The development of this thesis and the massing of evidence in its favor gives rise to a series of most important and entertaining discussions. The book is a scholarly production and gives a new interpretation of the science of geography.

CALVIN N. KENDALL AND GEORGE A. MIRICK. *How to Teach the Fundamental Subjects*. Boston: Houghton Mifflin Company, 1915. Pp. xii, 329. \$1.50.

"This book discusses the teaching of the common fundamental subjects found in elementary schools. It also contains suggestions as to what should make up the course of study in these subjects and it attempts to set forth some of the principles that should underlie methods of instruction and determine the selection of subject-matter. It is essentially a book for the use of teachers and supervisors of schools and for those who are preparing to be teachers..." Practically half of the book is devoted to the subject of English, including reading, composition, grammar, spelling, and penmanship. There is a brief and favorable mention of reading tests, emphasis on the importance of reading as a means to thought development, and stress is laid upon composition both oral and written as training in thought expression. Formal grammar is relegated to higher schools, and full account is taken of recent investigations in spelling in the advice for the study of that subject. In the discussion of penmanship reference is made to the recent scales, but their application is considered to be very limited. In mathematics the Courtis tests receive mention as useful indicators of the abilities of pupils, and there are helpful suggestions concerning the teaching of geography, history, civics, and hygiene. In general the book is written from the point of view of the practical school administrator rather than that of the student of education.

E. L. KEMP. *Methods for Elementary and Secondary Schools*. Philadelphia: J. B. Lippincott and Company, 1915. Pp. xiv, 311.

This is a general methods book of the older type. Part One deals with the principles of general method, and in it the fundamental doctrines show very little evidence of any disturbance by modern scientific studies of education. Part Two is devoted to the kindergarten, but the discussion does not extend as far as Madame Montessori or the more recent experiments in kindergarten practice. Part Three treats of method in the "branches," and the use of this term is in itself a good commentary on the point of view of the author. Here in addition to reading, composition, spelling, etc., are taken up such topics as foreign language, physical science, history, and mathematics. So far as a casual examination reveals, the book might well have been written in 1890, so little evidence does it show of the effects of recent discussions.

SAMUEL C. KOHS. *The Practicability of the Binet Scale and the Question of the Borderline Case*. Bulletin No. 3. Publications of the Research Department of the Chicago House of Correction, 1915. Pp. 23.

The author vigorously defends the Binet Scale against the assaults made upon it by the "unthinking and unknowing critics who have

rapidly advised the use of a new (?) scale claimed to be their own which easily reveals a remarkable plagiarism upon Binet's original." The present bulletin is based upon the examination of 335 cases whose chronological ages fall between 17 and 21. 116 of these are found of normal mentality and 219 or 65 per cent. are pronounced feeble-minded. There is a considerable discussion of individual cases, and reference is made to the use of the Woodworth and Wells Directions Test and to cancellation, construction, ethical discrimination, memory and arithmetic tests.

VACHEL LINDSAY. *The Art of the Moving Picture*. New York: The Macmillan Company, 1915. Pp. viii, 289. \$1.25.

In a racy and fascinating style the author discusses the possibilities of the moving picture from the point of view of art. According to him there are three essential types of photo-plays—plays of action, in which the outpouring of physical force at high speed is the main source of drama; plays of intimacy, based on the ability to photograph and magnify small groups at close range; and plays of splendor. Of the latter class we have the fairy-tale splendor, the patriotic splendor, crowd splendor, and the religious splendor. Each of these types the author thinks contains vast possibilities of artistic development, and it is his hope that audiences will become discriminating enough to approve of the artistic plays and to ignore the cruder ones.

HAMILTON WRIGHT MABIE, Editor. *Fairy Tales Every Child Should Know*. New York: Doubleday, Page and Company, 1915. Pp. 266.

This is a splendid edition of some of the good old fairy tales that always delight the hearts of young people. The book contains twelve stories, such as the "Enchanted Stag," "Puss in Boots," "The Ugly Duckling," "The Light Princess," "Jack the Giant-killer," "Beauty and the Beast," "The Story of Aladdin," and others. The book is well constructed, the print is large and clear, and there are numerous full-page illustrations in color.

GARRY C. MYERS. *Grasping, Reaching, and Handling*. Reprinted from the American Journal of Psychology, Vol. 26, October, 1915. 525-539.

A detailed study of the development of hand movements during the first year of an infant's life. The author considers the field of grasping, scratching movements, holding things, errors in reaching, putting things in the mouth, reaching distant objects with long objects, handing objects to a person, creeping for and with objects, and the development of strength in the hands.

JAMES W. NICHOLSON. *Stories of Dixie*. Cincinnati: American Book Company, 1915. Pp. 241.

These stories are largely historical in their nature, and are designed to interest the children of the lower elementary grades in the story of the development of the south. There are stories of the pioneers, the movement toward the west, the development of New Orleans, life on the plantations, religious and college life, the vicissitudes of the civil war, and the reorganization of social life in the south.

LUELLA A. PALMER. *Adjustment between Kindergarten and First Grade*. Bulletin 1915, No. 24. Washington: Bureau of Education, 1915. Pp. 36.

The kindergarten is an institution which has come to stay. There are now over nine thousand kindergartens in the United States, and in them there are over 400,000 children. The author deplors the fact that in many cases there seems to be a gap between the kindergarten and the public school, and it is with the intention of helping to close this gap that the present monograph is issued. The bulletin presents the results of a study of the views of superintendents, principals, and primary teachers on a desirable adjustment of the work of the kindergarten and the first grade. The chief suggestions for the kindergarten were more independence in handwork periods, more quietness during occupations, removal of the age limit so that a child may be placed in the class which is best fitted to his development, greater attention to English, and the introduction of reading and writing. The adjustments suggested for the first grade are more handwork, greater freedom in discipline, movable chairs and tables, smaller classes, more creative seat work, and the elimination of number work. There is also a discussion of the question of double sessions in the kindergarten.

RICHARD L. SANDWICH. *How to Study and What to Study*. New York: D. C. Heath and Company, 1915. Pp. v, 170.

Part One is entitled "The Principles of Effective Study," and emphasizes the value of self-confidence, of a regular schedule for study, of the value of recall in learning, the use of the synopsis, the cultivation of rapid reading, and the effects of imaginary competition. Part Two takes up the study values of the different school subjects as history, Latin, English, modern languages, mathematics, science, economics, psychology, drawing, and vocational studies, and ends with a consideration of the question: what is efficiency? While the book contains some statements which are open to question, it is in general well-conceived and successfully carried out.

JAMES LEROY STOCKTON. *Exact Measurements in Education*. Chicago: Row, Peterson and Company, 1915. Pp. 57.

The following theses indicate the general position taken by the author: (1) Measurements in education should have for their goal the computation of work and rate of work (power), in the sense in which these terms are used in mechanics; (2) Scales of force, space, and time can be made for school purposes and should be combined into standard units of work and rate of work; (3) Many units in many school subjects should be supplemented by single unit making possible the computation of mental work and rate of mental work (mental power) in all school subjects. The force involved in this computation is intelligence; the space is measured in elements of expression. These theses are elaborated on the basis of recent scales in handwriting, and applications of the Binet tests.

E. H. TAYLOR. *Mathematics in the Lower and Middle Commercial and Industrial Schools of Various Countries Represented in the International Commission on the Teaching of Mathematics*. Bulletin, 1915, No. 35. Whole No. 662. Washigton: Bureau of Education, 1915. Pp. 96.

The first part of this report consists of an account of the schools considered, arranged according to countries. There is a brief statement of the organization of each type of school, the entrance requirements, length of the course, by whom supported, aim of the school and of the mathematical instruction, courses in mathematics, methods of instruction in mathematics, preparation of teachers, examinations, and present tendencies. The second part gives for each type of school in each country the number of years of previous school attendance required for entrance, the approximate age of entrance, number of years in the course, number of hours a week spent in the school, number of hours a week given to the study of mathematics, and course of study in mathematics.

WILLIAM T. WHITNEY. *Moral Education. An Experimental Investigation*. Boston: Leroy Phillips, 1915. Pp. vii, 108.

There is an introductory chapter on the demand for moral education, which is followed by an account of an investigation on the moral life of 600 boys and 600 girls. Their home life, their religious and moral training, their deportment in school, their scholarship, and all that pertains to home training and the training received in the public and secular institutions were carefully observed and examined. The object of the study was to ascertain the relation between religious training and deportment, home training and deportment, and the

effect of deportment upon scholarship. The results are expressed in the form of tables and curves which show the development of both groups. Further chapters point out the relation between the home and morals, suggest the proper method for the teaching of morality, consider the relation between the physical and the moral life, and between manners and morals, discuss the recitation as a medium for moral instruction, and show some of the things the public schools have done in preparing pupils for their life work. According to the author the weak spot in the school is the lack of enough thoroughly trained teachers.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

SOME NORMS OF DARTMOUTH FRESHMEN¹

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SUMMARY

One of the more immediate problems for workers in the field of mental measurements is the accumulation of norms. Two hundred Dartmouth freshmen were measured individually and their performance in seven tests is here presented in graphic form, by means of percentile curves of distribution. The "ogive" percentile graph here used, has an advantage over the more common "surface of distribution," in that it serves as a convenient scale, and facilitates comparison of additional individual measures with these measures already made on a large group.

Progress in the science of mental tests may at the present time wisely take any one of several directions. We may make intensive studies of individual tests in order to bring the methods and procedure in these tests to a maximum of simplicity and precision, and to evaluate them in comparison with other available tests as regards relative reliability, convenience, and applicability to different purposes. We may study these tests from the theoretical side in the effort to analyze the mental functions measured, and to learn the facts about the interrelationships of these functions. Or, accepting the formulations of method already worked out, and not giving ourselves

¹ Read at the Philadelphia meeting of the American Psychological Association, December, 1914.

deep concern regarding either theoretical or practical implications of what we are doing, we may devote ourselves to the somewhat humbler but very necessary task of accumulating norms of performance and constructing scales. It is to this latter type of research that the present offering belongs.

THE TESTS DESCRIBED.

This paper reports the results obtained in mental tests given during the year 1913-14 to two hundred members of the Dartmouth freshman class. All of the tests were given individually except the two memory tests, which were given to groups of from eight to twelve subjects. The writer had the assistance of a number of psychology students,² and the results are consequently representative of what can be obtained with these tests in the hands of relatively unpracticed experimenters.

The *endurance of grip* test was given by the method of continuous contraction. The procedure specified by Whipple³ was followed, except that the subject was permitted to stand and to hold the dynamometer in a natural position by his side. The score in this test is the index of fatigue, computed according to the formula

$$X = \frac{r_1 - r_2}{r_1}$$

where r_1 is the average of the first four readings and r_2 the average of the last four. It should be noted that the standard directions to the subject do not always insure maximal effort at the start.

The *tapping* test was given in the standard manner used by Wells. The precise procedure specified in Whipple's *Manual*⁴ was followed with two exceptions—the records with the right hand only were taken; and the entire tapping record, including the very first taps after the signal "Now," was recorded on the kymographic drum. The writer can see no reason for omitting to get a record of the first two or three seconds of tapping. They are sometimes the most interesting and characteristic of the

² He wishes to mention in particular the valuable coöperation of Messrs. R. B. Teachout and B. Ruml.

³ G. M. WHIPPLE. *Manual of Mental and Physical Tests*. 1914, p. 117.

⁴ Op. c., pp. 130-134.

whole record; and moreover, the procedure specified by Whipple to exclude these taps puts an unnecessary tax upon the experimenter. The number of taps for each five-second period of each trial was counted, and the results are given in terms of what Wells calls the "total efficiency" score, the average number of taps in five trials of thirty seconds each.

The only test in sensory discrimination included in the series was *discrimination of lifted weights*, and this test was abandoned after one hundred records had been gathered. The rapid procedure necessitated by limitations of available time seemed to be giving measures quite too unreliable to be useful.

In the test of *memory span* for auditory digits, two successes out of three trials was counted as passing. The smallest number of digits given was six, since at the time the experiments were planned, it was not supposed that any Freshman would fail on that number. As a matter of fact, six per cent. of the class did fail on numbers of six digits; consequently we have no record of the lower limit in this ability.

The test of *logical memory* consisted in the written reproduction of the sense of a prose paragraph, immediately after hearing it read aloud. The score is in terms of the percentage of ideas reproduced. The selection was the paragraph from the Columbia freshman tests, beginning, "Tests such as we are now making are of value both for the advancement of science, and for the information of the student who is being tested."⁵

For the *cancellation* test, use was made of the Woodworth and Wells' number blank, Form A.⁶ A stop-watch was used in taking the time required to cancel the digit 1 from among the 500 digits on the first half of the blank; and then as soon as this time had been recorded, the time was taken to cancel the 1's from the second half of the same blank. The score represents the average of two trials in making fifty reactions. Practically no correction for errors needed to be made, except in rare instances when an entire line was skipped. The rule was followed of adding 2 per cent. of the time for each error or omission.

The *color-naming* test was given as specified by Woodworth and Wells (p. 49), the entire blank being used at one trial, and the time being noted for the first and second halves. Given in

⁵ MARY T. WHITLEY. *Tests for Individual Differences*, 1911, p. 55.

⁶ R. S. WOODWORTH AND F. L. WELLS. *Association Tests*. Psychological Monographs, 13: (whole No. 57): 1911, 24.

this manner, however, the two scores cannot be taken as two measures of the same trait, for subjects do not ordinarily do as well in the second half of this test as in the first half, as the writers of the monograph themselves pointed out. The first half of the blank should be used, and then after a pause, the second half; or else the blank as a whole should be used twice, in different positions. We give here our results in terms of the time taken to complete the blank as a whole (100 reactions).

What has been said about taking the time of the first half and the second half of the color-naming test applies equally to the *directions* test. (Woodworth and Wells, p. 72.) Our results with this test will not be published because, before the entire group had been tested, enough information regarding this test had spread among the freshmen to invalidate the later results. This is one of the tests which might better be given to the entire group at once, for reasons that are not limited to those of economy of time.

Ten of the *logical relations* tests were used,⁷ including easiest opposites, easiest verb-object, supra-ordinate concept, subordinate concept, part-whole, whole-part, agent-action, action-agent, attribute-substance, and mixed relations. It was found most convenient to have the numerous lists of stimulus words arranged in a small scrap book, so that the turning of the pages would disclose first the sample instruction words, then the first half, and then the second half of the successive tests. The responses were spoken aloud, and the time taken for each list of ten reactions. The results here presented combine into a single measure the scores made by the student in all of these logical relations tests except the mixed relations or analogies test, which is more difficult than the others, and is therefore presented separately. The nine other logical relations tests yielded eighteen measures. A typical score for each individual was found by taking the ninth of these eighteen measures, beginning with the fastest. This is almost identical with the median.

The *perception of form* test is one for which I am indebted to Mr. Albert S. Osborn,⁸ a specialist in handwriting, the detection of forgeries, etc., and the author of the volume entitled "*Questioned Documents*." Mr. Osborn calls this the "Form Blindness Test" because he devised it for the purpose of finding

⁷ WOODWORTH AND WELLS, pp. 56-64.

⁸ A. S. OSBORN. *Form Blindness*. Case and Comment, 19: 1913, 800-897.

whether or not a judge is capable of noticing small differences and similarities of form. The same word was written fourteen times on seven different typewriters of the same make. These fourteen samples, arranged in irregular order, were photographed and enlarged. The test measures the time required to find the seven pairs. A much longer form of the same kind of test measures an ability in noting individuality in handwriting. A sheet is shown on which is the word "York" written forty times by twenty writers, making twenty pairs. The comparison words are unmistakable when found; consequently this is a test in quickness of noticing similarities of form. Only the briefer test was used with the freshmen.⁹

Suggestibility was tested by means of progressive weights, and also by means of three standard normal illusions. The use of the latter material may be illustrated by the procedure with the size-weight illusion. The freshman was shown the two wooden blocks and given instructions in the following words: "The smaller of these two blocks is weighted with lead so that it actually weighs the same as the larger block. The two are equal in weight. But most people, when they heft first one and then the other with one hand, like this, say that the small one feels heavier than the large one. How does it feel to you?" This procedure, it will be noted, tends to select those who are negatively suggestible, those who suspect the experimenter is trying to fool them, when as a matter of fact, he is entirely frank and straightforward. Eight per cent. of the group were susceptible to this form of suggestion.

Four *ingenuity* tests with standard puzzles were used; but after about eighty freshmen had been tested, it was impossible to be sure which of the remaining freshmen came to these tests ready-primed. Consequently no report on these data will be made.

DISCUSSION OF RESULTS

A summary of results is given in the accompanying table, which shows nine of the tests arranged in order of variability. For each test is shown the score reached or exceeded by one-

⁹ The writer understands that Professor Jastrow has been for some time making use of this material at the University of Wisconsin, but no results have been published as yet.

half of the group of 200 freshmen; the standard deviation from this central tendency; the coefficient of variability within the group, or ratio of standard deviation to median; and the range from poorest to best.

NORMS FROM 200 DARTMOUTH FRESHMEN

Test	Median	σ	Coef. of Variability	Range	
				Poorest	Best
1 Tapping Average of five 30-sec. trials	211.6	24.18	0.11	151.8	278.4
2 Color Naming Total time, 100 reactions	56.2 sec.	9.02	0.16	91.6	33.2
3 Logical Relations Time for 10 reactions	12.6 sec.	2.16	0.17	20.0	8.2
4 Memory Span Auditory digits	7 digits	1.38	0.20	5 or less	12.0
5 Mixed Relations Time for 10 reactions	28.5 sec.	7.63	0.27	54.9	13.5
6 Cancellation Time for 50 reactions	48.3 sec.	15.06	0.31	144.0	31.5
7 Logical Memory Per cent. of ideas reproduced	35%	14.20	0.41	7.0	87.0
8 Endurance of Grip Index of fatigue	0.32	0.14	0.46	0.68	(—0.37)
9 Perception of Form Time for Osborn Test No. 2	4 m. 5 sec.	3 m. 3 sec.	0.62	Failed in 20 min.	55 sec.

Comparing these records with those of other groups, we are struck first of all with the relatively poor scores in memory span and logical memory. In the latter tests, the Columbia freshmen score 44.5 as over against 35.0 for this group.

In the cancellation test we find a much wider range and a lower central tendency than Woodworth and Wells found (p. 29). The same may be said for the results in the color-naming test, and the tests in logical relations. In each of these types of mental task, the freshman mind seems to work rapidly. Most interesting is the showing made in the tapping test. The median score, 211.6, is not far below the score of 220.4 given by Wells¹⁰ as typical for a normal individual near the limit of practice.

¹⁰F. L. WELLS. *Normal Performance in the Tapping Test*. American Journal of Psychology, 19: 1908, 438.

CONVENIENCE OF THE OGIVE

The data in seven of the tests have been thrown into the form of percentile curves of distribution. (Figures I-VII.) The reason for choosing Galton's "ogive" form of graphical representation is that it furnishes a convenient scale.¹¹ The curve at each point shows the percentage of the group doing no better than the score there indicated. Knowing the score made by any individual, one can by reference to the chart instantly assign him a rank among one hundred of his classmates. For example, having found that a certain student requires 22.6 seconds to complete the color-naming test, reference to the graph shows at a glance that this score corresponds to the rank of "thirty-third from the poorest" among a hundred freshmen.

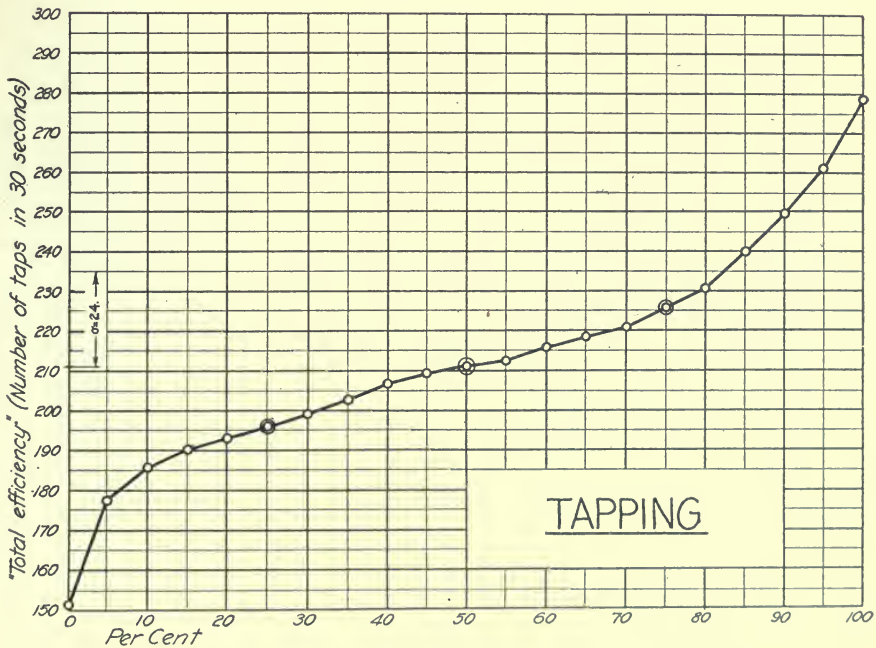


FIGURE I.

¹¹ G. U. YULE. *An Introduction to the Theory of Statistics*, 1911, p. 152.

Some readers may be interested to compare the ogive with the ordinary "surface of frequency" graph, and for this purpose the data regarding the index of fatigue in the endurance of grip test are charted in both ways. (Figures VII and VIII.)

No percentile charts are given for the memory tests because in the method of scoring used, the steps in the scale are too few to make a comparison by the method of relative position useful.

In all of the charts given, it will be noticed that the distribution is sufficiently smooth to warrant interpolation.

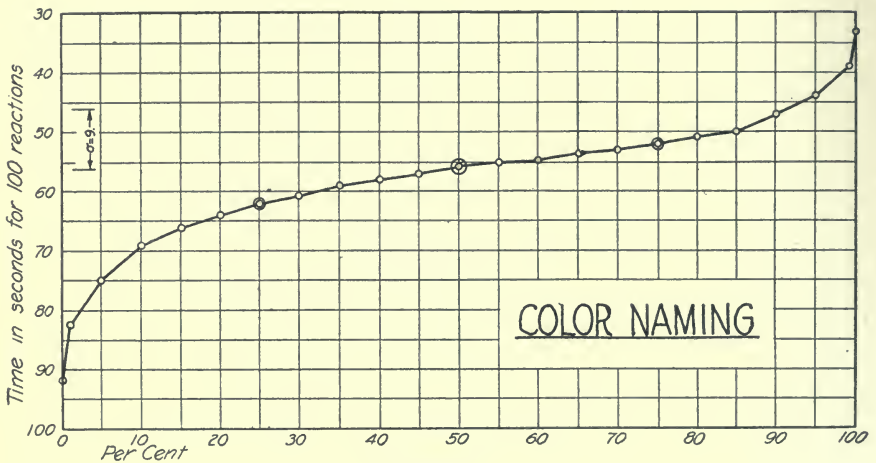


FIGURE II.

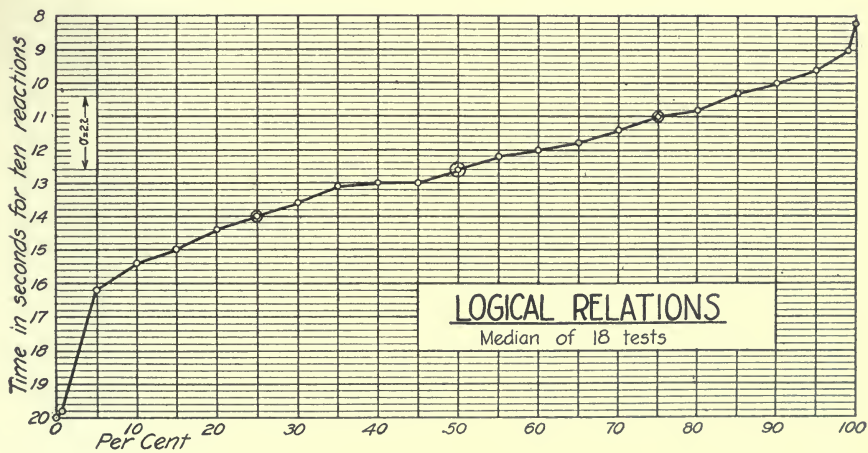


FIGURE III.

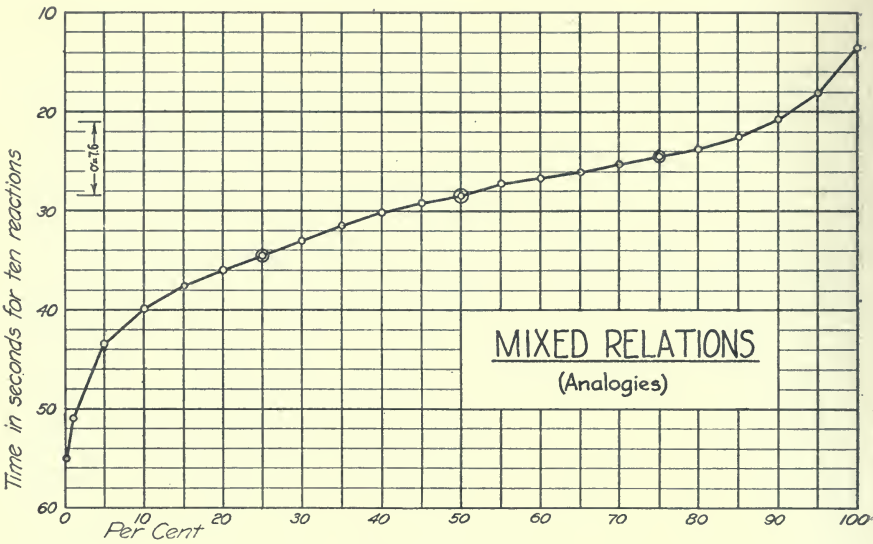


FIGURE IV.

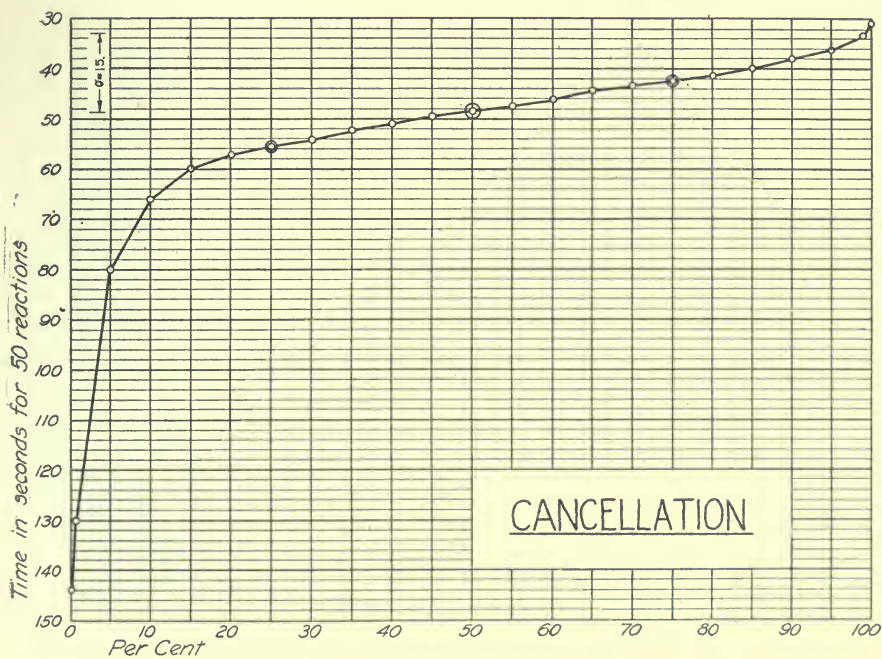


FIGURE V.

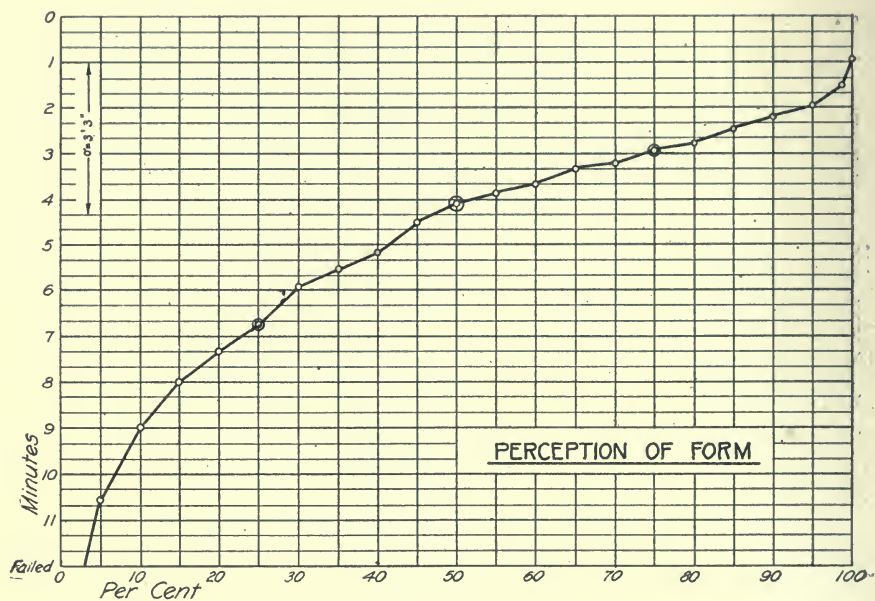


FIGURE VI.

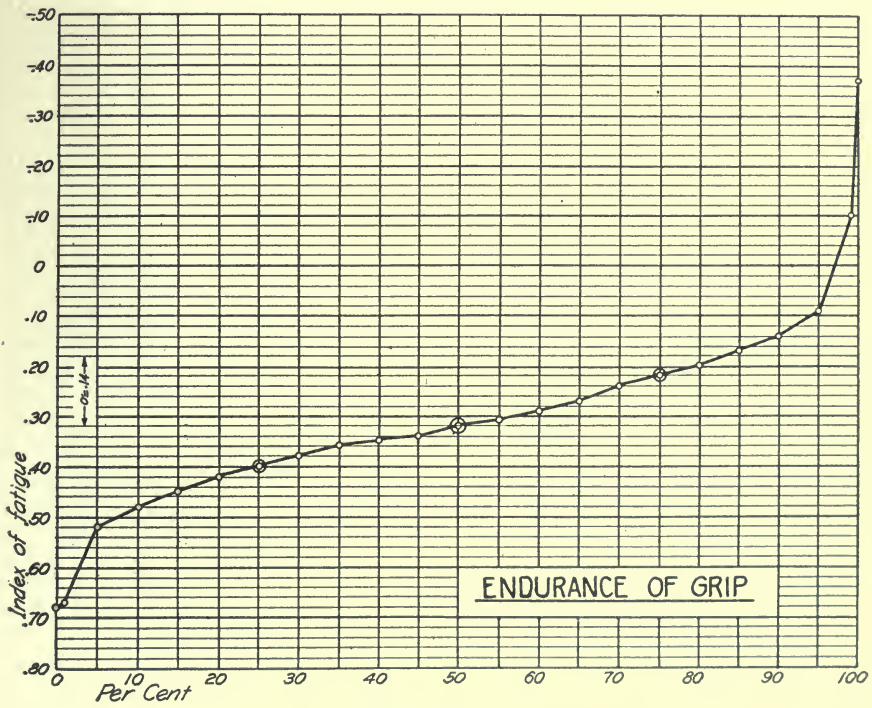


FIGURE VII.

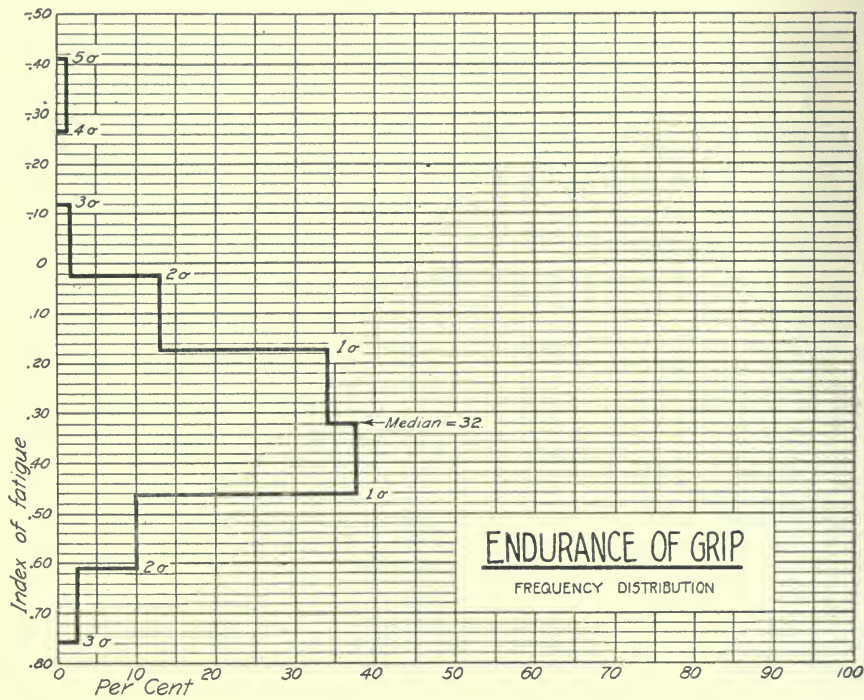


FIGURE VIII.

A POINT SCALE FOR THE MENTAL MEASUREMENT OF THE BLIND¹

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Ohio*

The Bureau of Juvenile Research had an opportunity to make mental measurements of the 224 blind pupils of the Ohio State School for the Blind in May, 1915. This opportunity resulted from the superintendent's desire to know who of his pupils were feeble-minded; some of them were so evidently deficient in mental capacity that any layman would know them to be defectives. The question as to who were defective, however, in this day of mental measurement, was naturally put to those who have skill in mental measurement. The opportunity also came from another quarter. The Supervisor of Instruction for the Blind in three cities in Ohio: Cleveland, Cincinnati and Toledo, had long felt the need for accurate testing of the mentality of blind children. Mr. R. B. Irwin was really the instigator of our work at the Ohio School for the Blind. From the point of view of such day school work as that of Mr. Irwin and from the point of view of the superintendent of a large boarding school, such as our State School, it is important to have a measuring scale for the intelligence of blind persons similar to the scales in use for seeing persons. It is as desirable to separate the feeble-minded blind at the beginning of their school careers, or as soon as feeble-mindedness becomes evident, as it is to separate the feeble-minded seeing children from the normal. The feeble-minded blind should have the benefits of special education, and the schools for the blind should be relieved of the burden of carrying feeble-minded children along in the regular school course.

It became evident, at once, that several of the Binet tests cannot be administered to blind persons. Of the Binet tests adopted by Yerkes and Bridges in their point scale for mental measurement these are impossible for the blind:

¹ Full description of the tests, and instructions for administering them, together with the results of this survey, are being published by the Psychological Review Company as a Psychological Monograph.

1. Binet pictures.
2. Comparison of 5 and 6 cm. lines.
3. Copying square and diamond.
4. Resisting suggestions in lengths of lines.
5. Choosing the prettier of two pictures.
6. Pointing out omissions in outline pictures.
7. Drawing from memory the two Binet figures.

We set about constructing a point scale for the blind on the outline devised by Yerkes and Bridges, and made substitutions, in so far as possible, for the above mentioned tests. For the enumeration of objects in pictures we adopted Mr. Irwin's suggestion of placing before the blind subject a box in which there were eight articles: a doll, a penny, a marble, a base ball, a spoon, a shoe string, a baby shoe, and a coat button. The subject was asked to lay these pieces out upon the table, one at a time, as he named them. As a substitute for *resisting suggestions* of the Binet lines we used Irwin's wooden cubes. Cubes of wood, measuring 15 mm., 22 mm., 29 mm., and 36 mm. were used. The 22- and 15-mm. cubes were placed in the subject's right and left hands, respectively, and he was instructed to give back the biggest cube. Then the 29- and 22-mm. cubes were placed in his right and left hands, respectively, with the same command. Next the 36- and 28-mm. cubes were placed in his right and left hands, respectively, with the same command. Then followed, three times over, the placing of two 36-mm. cubes in his two hands with the same command. If he continued, in these last three cases, to give back the right hand cube as the larger, he *failed to resist the suggestion*; if, on the other hand, he gave back the left hand cube as the larger, or said that the two were equal he resisted the suggestion. He received one point credit for each one of the three cases in which he resisted the suggestion.

For the 5 and 6 cm. lines, concerning which judgment of relative lengths was required, Mr. Irwin had suggested using two sticks, 4 and 6 cm. long. These sticks are put into the subject's two hands and he is told to hand back the longer. They are then reversed, and the same command repeated. If he gives back the longer, both times, he receives one point credit for the performance. For the esthetic choice between the pairs of outline pictures of Binet, Irwin had likewise suggested comparisons

of fabrics as substitutes. The following pairs were adapted: (1) serge and silk; (2) velvet and serge; (3) velvet and Brussels carpet. Choices of (1) silk, (2) velvet and (3) velvet, made two times over, in each case, secure three points credit on the Point Scale. The disarranged sentences were given to the observer in *New York point*, with due separation of words—all of the words of each sentence being on one line, and without capitals. The subject was asked to read the words, and the words were repeated to him so that the examiner was assured the subject knew the words before he was asked to arrange them in a sentence. Two points credit were allowed for each one of the three sentences correctly arranged. For the other tests, namely: the two drawing tests, and the missing parts of pictures, no parallels have been found suitable for administration to the blind. Other tests were added to the Point Scale for the blind as follows:

(1) Goddard's Adaptation Board. A board measuring 22 x 28 cm., in which are four round holes, three of which measure 62 mm. in diameter, while the fourth measures 65 mm. in diameter; and a circular block twice as thick as the board and measuring 65 mm. in diameter so that it fits snugly into the larger hole, constitutes the apparatus. Two points credit are allowed for the correct performance in four positions different from the demonstration position; and one point credit for correct performance in any three of these four positions. The subject is allowed to follow the movement of the board, in changing positions, with his hands.

(2) The Size-Weight Illusion. In this test two wooden cylinders of the same weight (55 gm.) and same length (35 mm.), but of different diameters, one being 19 mm. and the other 61 mm. are put into the two hands of the subject and he is asked to give the examiner the heaviest one. If he gives the smaller as the heaviest, and repeats the same performance when the cylinders are reversed in his hands, he is allowed one point credit.

(3) Orientation. (a) The examiner sat down opposite the subject with his hands upon his knees and explained to the subject that he was sitting opposite to him and that his hands were upon his knees. He was then asked to be careful, take thought before he acted, and then to place his hand upon the examiner's right hand. If he did this correctly, and also placed his hand correctly upon the examiner's left hand, he was allowed one point credit. (b) A further test in orientation consisted in this: The subject was asked to stand; he was so placed that he

faced the north, and was told he was facing the north. He was then asked to point successively to the east, the west, and the south. Likewise, he was faced to the east, and told he was facing the east. He was then asked to point to the south, the north, and the west. Correct pointing in all of these directions in both positions was credited with two points. Correct performance of all three in either one of the two positions, that is: when facing north or when facing east, was given one point credit.

(4) Finger Tapping: The Knox cube test, as revised by Pintner,² was adapted to the blind as follows: The subject was asked to place his left hand (if right handed), with palm upward, upon his thigh. He was asked to hold the hand comfortably relaxed, but with the fingers reasonably well spread out. The examiner took the index finger as point *one* of the Knox cube test, and the little finger as point *four*. Of course nothing was said of this to the subject. To the subject it was explained the examiner would touch his finger tips with the rubber end of a lead pencil, and that he would then put the pencil into the subject's right hand and ask him to touch the finger tips of his left hand in the same way the examiner had done. Illustration of touches on the finger tips and the way the pencil would be put into his own hand were then given. Line A 1, 2, 3, 4 was then tapped out upon the finger tips of his left hand, the pencil put into his right hand, and he was asked to do the same. Line A was considered a practice line and not scored. X, Y, B, C, D, E, F, and G, were each given one point credit for correct performance.

(5) Terman's Test, Reversing Series of Digits, was adopted. Any one of three trials, proving correct, was allowed one point credit for each number of digits from three to six inclusive.

With these modifications of the Yerkes-Bridges Point Scale our record blank for a point scale for the mental measurement of the blind, contains twenty-two tests, and provision for one hundred points of possible credit. This point scale was used in testing 142 of the 224 pupils at the Ohio School for the Blind. The other 82 pupils had sufficient vision to take the regular Binet and Yerkes-Bridges tests. The point scale achievements showing the subjects' records arranged in the chronological year groups, by their nearest birthdays, follow:

²Cf. *The Standardization of Knox's Cube Test*, by Rudolf Pintner. *The Psychological Review*, Sept., 1915, p. 395.

At 7 years one subject made 44 points.

At 8 years three subjects averaged 45 points.

At 10 years fifteen subjects averaged 57 points.

At 11 years fourteen subjects averaged 61 points.

At 12 years eleven subjects averaged 64 points.

At 13 years nine subjects averaged 73 points.

At 14 years fourteen subjects averaged 78 points.

At 15 years nine subjects averaged 82 points.

Sixty-one subjects, sixteen years and beyond, ranged up to 88 points in averages for year groups. The irregularities of the later adolescents' averages are somewhat more marked than the averages up to fifteen years inclusive.

Nine 16 year olds, for example, dropped to 80, seven 18 year olds averaged 87, and eleven 19 year olds averaged 84. This irregularity is slight, and indicates that the school population in question is over-weighted with old defectives, and that these are not regularly distributed through the chronological year groups. Statistics from a larger number of blind persons would iron out these irregularities. It is highly desirable to have more data from the use of this point scale for the blind children of ten years and less. The data at hand from ten years to fifteen inclusive are very satisfactory, both in the consistent advances which the averages make from year to year, and in the close paralleling from similar data from seeing children, as reported by Yerkes and Bridges. These data afford a reasonable basis upon which to classify blind children of these ages and older, with respect to their intelligence development. For example, one of our subjects twelve years of age scores 23 points, while the average for twelve year olds is 64 points. He must, without any question, be rated as feeble-minded. Likewise a sixteen year old, who scores 42 points, while the average for sixteen year olds is 80 points, and 42 is apparently about what can be expected of a nine year old blind child, must, unquestionably be rated as a high grade defective having a mentality near that of a nine year child.

Likewise a 21 year old makes 61 points, which is the average attainment of eleven year old blind children. This subject must be rated as subnormal, or a border line case, and must be reckoned with as needing more care than as ordinary blind person. He should have had special education along industrial lines,

and must have more than ordinary attention to enable him to adjust himself to an independent existence.

The Point Scale for mental measurement of the blind proves itself then at once a much more effective means of rating the intelligence of the blind pupils of a given school, than would a partially available year scale like the Binet-Simon. By this means of comparison of each pupil's mental ability with that of every other and with the year group averages, there was no difficulty in rating each one with fairness, and in determining with considerable accuracy who were the feeble-minded. As a result of this examination thirteen were eliminated from the school.

These averages, with our instructions and descriptions of the tests, constitute a basis upon which any one may now measure and rate the intelligence of any blind person ten years or more of age.

DISTRIBUTION OF PRACTICE PERIODS IN LEARNING

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Those engaged in the administration of education feel a need of more knowledge in regard to the matter of distributing the learning periods. Much time is given to the arrangement of the program of studies in regard to the subject matter, but not so much attention is given to the more important question of how to arrange a program that will be most profitable to the learner.

PROBLEM STATED

How shall the periods of learning be so distributed as to give the most economical result? This problem is of especial interest to educational psychologists who have made experiments in both animal and human psychology in an effort to solve it.

PREVIOUS EXPERIMENTS

In regard to periods of work up to a limit of twenty or thirty minutes, the conclusion has been reached that one practice period per day gives better results than any other larger number per day. Lashley found in archery practice that the group which made five shots per day showed greater improvement for the same number of shots than those who made twenty shots or forty shots per day.

As yet, no conclusion has been reached in regard to the value of alternate days' practice compared with daily practice. Pyle, from his experiments in transcribing reading matter into new characters, concluded that daily practice is better than practice on alternate days. He had, however, only six subjects in the test, and, even to this conclusion, he adds that after the initial stages alternate days may be better.

Professor Leuba and Miss Hyde of Bryn Mawr have added some information to this question in their tests on "Hand Movements." Their test was to find out the progress in skill in writing English prose in German script. Four divisions were made of their subjects: One group working twice per day, one daily, one

on alternate days, and another every third day. From the chart on page 41 will be seen in the progress, as noted, very little difference between the alternate and daily practice groups, but in comparing them with other groups a decided showing is found in favor of the daily and alternate-day groups. One defect in this comparison is the short length of the curve. The indications are that with further practice the alternate group would compare yet more favorably. The table below shows that at the end of the tenth trial the group working on alternate days was superior.

Twice per day 865 (Words)	Once per day 1115	Alternate days 1175	Every third day 985
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TECHNIQUE OF EXPERIMENT

The following experiments were devised to test the relative merits of daily and alternate day's practice in such muscular activity as javelin throwing. Although such was the chief function of the experiment, yet other practice periods were given to different groups. There were twice per day and once per week groups. Some data will be shown as the result of the latter. The most careful study was given to the five-times-per-week, the three-times-per-week, and the once-per-week groups.

The experiment was performed with normal school girls from the senior and junior classes. Three groups of ten girls each from the senior class were formed for the five times, the three times, and the once per week work, respectively, and two groups of seven each from the junior class. One group threw five times per week *daily* and the other twice per day, the latter making five throws in the morning at 8:45 and five in the afternoon at 3:00.

I shall designate the group that threw five times per week from Monday to Friday as Group I; the group that threw three times per week, Monday, Wednesday, and Friday, as Group II; the group that threw once per week on Thursday as Group III.

APPARATUS AND METHOD OF EXPERIMENT

The following description will explain the arrangement of material used in the experiment. A soft pine board about 70 cm. square was firmly fastened to the wall of a classroom. In the center of the board a small spot 1 cm. in diameter was painted. This was the target and was put at the height of 150 cm. from the floor. Twelve feet from the target a chalk line was drawn on

the floor. When the subject made the throw she placed her toe on this line. The javelin was handed to the thrower and she was told to hit the target, throwing with the left hand. After each throw an assistant handed the javelin to the performer so that her position was not changed. No other directions were given nor was any comment to be made upon the result of any throw. Only the persons helping in the experiment were in the room and generally only one subject came to the room at a time.

SELECTION OF GROUPS

The thirty students in the senior class were given a trial throw on Monday, Nov. 9, at 1 P. M. Each person was asked to throw five times with her left arm. If she was accustomed to using her left arm for throwing, she was excused from the experiment. The distance was found to be of such length as to require some effort, and yet was not beyond the strength of any of the performers, with, perhaps, one exception. After the thirty girls had thrown five times, the average of the five throws was taken as a measure of possible ability and groups were then formed so as to have ten in each whose ability would be about equal. The are the figures showing the relative abilities as evidenced in the following test throwing:

<i>Average in Centimeters of Ten Girls for Five Throws</i>		
Group I	Group II	Group III
86	85.2	85.5

No attempt was made at introspection while the students were throwing, but the difficulty experienced in performing the task was plainly evident. The erratic throwing and the new situation aroused an emotional attitude in most of the girls and called forth such expressions as "I'll never do it," "I never could do anything with my left hand," etc. Such conditions persuaded us that we were attempting to form a pattern in the nervous system whose elements had very little past association. It seemed that here was some virgin soil upon which might be grown habits whose growth, if carefully noted, would yield some evidence of the conditions which would be most favorable for improvement.

Some one interested in formation of habits which pertain to schoolroom work may ask, "What can you carry over from such an experiment that will throw any light on solving problems of

learning in school?" Learning is making connections in the nervous system. These connections are supposed to be formed by the impulse breaking over or through the synapse. What difference can there be in forming this connection in the neurones controlling the movement of the arm and those controlling the cortical set that responds with a rule in grammar or any word response? Thorndike says that the same law of behavior in the neurones will be found to account for the effects in both typewriting and the learning of nonsense series. There are connections lacking in both places. Of course phylogeny may explain to us that neural bonds which are made in such movements of hand and arm are older in the race's history and therefore easier to form anew than the so-called higher connection; but who can prove that the same methods of improvement will not avail for all neurones? Many school habits of motor type are very similar to habits formed in this experiment and it will not be useless for the pedagogue to consider such lessons as the experiments in skill may have to give. The great objection to the so-called mental tests (as Dr. Watson states) is to be found in the fact that the complexity of the word habits makes it difficult to have any assurance that many past associations are not entering into the supposedly new arc formation.

We state these reasons not as an excuse for our experiments but as an explanation of why we consider such work a good source from whence pedagogy may derive some help. The more isolated the arc formation the more easily conditions can be controlled.

PROCEDURE OF EXPERIMENT

Winch states that one ought to have an experiment planned so that whatever bias the experimenter has may have the harder part of the problem. If there was any bias in the mind of the experimenter it was in favor of daily practice, but the conditions were absolutely the same for all the groups, and a careful daily watch was kept on any point or outside influence that would affect the results. At 2:30 P. M. on Wednesday, Nov. 11, Group I began their throwing and threw on each succeeding school day until they had had thirty-four practice periods. At 1:00 P. M. on Wednesday, Nov. 11, Group II made their first throw in the experiment and continued to throw every Monday, Wednesday, and Friday, until their practice periods numbered thirty-four. On Thursday, Nov. 12, at 1:00 P. M.

Group III commenced their practice of once per week. They have not had an opportunity to have as many practice periods as the other two groups, but their progress is noted in comparison with the other two groups in Fig. 1. This graph is made from the total of daily averages for each group.

It will be seen that the initial improvement was somewhat more marked in Group I than in Group II; but from the middle of the practice periods the improvement of Group II is very much faster than that of Group I. At the end of the twenty-third practice period for Group I came two weeks intermission for the Christmas Holidays, and you will notice a perceptible rise in the curve at that point. This point is marked on all the curves by an X. Not so marked, however, is the rise of Group II showing that the lapse of time made very little perceptible difference. It should be noted that in Group II one of the girls was very slow in learning; in fact, from a glance at her score in Table V it will be seen that there was little improvement. Her high score was handicap to her group whose progress would have been still more marked in comparison with Group I. (By high score we mean far from target and by low score near target.) There were some making high scores in Group I, but none that seemed to have as much difficulty in reaching the board as the subject in Group II. It might have been more exact not to count this subject in the result, as her high score was due to the fact that so many throws fell short of the target, showing lack of strength. This omission would add to the favorable result for Group II.

In Table I you will note the sum of the scores made by Groups I and II. Comparing practice periods at each stage it will be seen that Group II makes a lower score in nineteen periods out of the thirty-four. The result given in the table shows the progress that was evident to the observer. Those in Group II (with one exception) appeared more confident and handled the javelin with more ease and accuracy, as will be shown from the median and the standard deviation in Table VI.

The dotted line on the graph shows the progress of Group III. Although the test practice gave evidence that Group III was equal to the other groups, yet on beginning practice this group made the best score. On the fourth and fifth practice they made a higher score than Groups I or II, but from the fifth practice there was rapid improvement to the thirteenth, when a lower score than either of the other groups was reached. In fact the

TABLE I.
Average for Two Groups

Group I Ave.	Group II Ave.	Group I Ave.	Group II Ave.	Group I Ave.	Group II Ave.
*80.01	82.24	57.25	62.92	56.16	46.96
67.41	72.90	53.35	63.18	51.49	46.48
75.42	76.61	54.66	53.42	58.17	46.96
70.33	76.41	66.25	64.14	47.80	51.77
68.60	68.19	57.59	63.06		
74.33	65.30	52.95	60.49		
71.95	57.91	57.79	59.49		
71.42	63.50	58.14	55.47		
75.97	61.66	66.16	48.72		
74.57	68.42	58.57	46.53		
73.43	74.77	68.81	43.93		
57.35	59.17	57.58	47.89		
50.81	60.91	55.64	42.39		
57.48	70.51	70.78	40.58		
53.22	67.76	61.26	50.21		

*Daily Average for
Each of 9 in
Retention Test*

Group I	Group II
59.0	50.7
53.6	45.6
55.5	53.0
45.9	46.3

TABLE II.

Trial Practice

Group I	Group III	Group II
Miss Hu. 38.4	Miss Co. 39.4	Miss So. 45.4
" He. 57.4	" C. 54.9	" Vo. 46.2
" Hei. 59.1	" Hip. 59.5	" Fr. 59.8
" Lau. 69.2	" Ha. 67.4	" Do. 64.2
" Sk. 70.0	" Ho. 72.5	" McK. 79.3
" Jo. 88.9	" B. 84.8	" Har. 79.7
" McC. 88.9	" Lit. 93.2	" Br. 94.6
" Wh. 110.4	" W. 104.8	" St. 103.8
" Du. 120.2	" Col. 129.7	" Ru. 137.6
" Ru. 158.2	" Ma. 149.2	" Jac. 141.9
860.7	855.4	852.5

TABLE III.

*Median and Standard Deviation Sheet
for
Five Times per Week Group*

	1st 50		2d 50		Last 50	
	Med.	S. D.	Med.	S. D.	Med.	S. D.
Miss H.....	45	32.52	42	25.8	39	23.6
" He.....	105	46.4	63	33.4	40	24.72
" Hei.....	60	38.0	56	24.6	41	23.35
" La.....	50	37.65	35	34.0	57	35.0
" S.....	39	29.34	40	28.6	50	37.3
" J.....	65	45.51	43	23.4	45	28.8
" McC.....	77	36.79	32	33.3	35	25.0
" W.....	63	44.6	65	39.7	53	30.5
" Du.....	120	40.29	78	42.9	75	53.2
" Ru.....	46	42.0	53	35.9	52	38.2
Av. Total.....	67.0	39.31	50.7	32.16	48.7	31.96

* Average number of centimeters from target.

score at this point was lower than any score made by Group II until the twenty-fourth practice period and lower than any reached by Group I until the very last day or the thirty-fourth practice period.

From this result we do not draw any definite conclusion in regard to the efficacy of distribution for once per week, but the curve does indicate that for such work as was performed in this experiment one period per week gives a good distribution for learning.

ACCURACY OF LEARNING

By looking at the standard deviation and median, Table VI, one will note that there was improvement in both Group I and Group II for average median and for average standard deviation

TABLE IV.
Median and Standard Deviation Table
(once per week)

		1st 50		2d 50	
		Med.	S. D.	Med.	S. D.
Miss Co.	55	34.7	50	29.4	
" C.	78	48.1	40	28.2	
" Hip.	40	25.9	28	19.0	
" Har.	75	51.4	75	35.0	
" Ho.	63	38.9	45	28.3	
" B.	43	28.7	54	31.5	
" L.	48	21.3	43	22.3	
" W.	110	45.3	55	30.19	
" C.	73	32.5	51	29.6	
" M.	92	55.8	41	33.1	
		677	382.6	482	286.5

TABLE V.
Median and Standard Deviation Sheet
for
Three Times per Week Group

		1st 50		2d 50		Last 50	
		Med.	S. D.	Med.	S. D.	Med.	S. D.
Miss So.	59	36.4		37	23.5	33	17.2
" V.	49	27.1		55	28.0	40	18.5
" F.	61	36.3		54	32.6	46	34.0
" D.	69	32.5		30	16.3	32	16.3
" McK.	60	35.8		55	27.0	42	23.5
" H.	56	42.0		55	31.0	40	31.2
" Br.	90	45.8		48	51.9	51	36.5
" St.	61	39.9		62	27.9	31	19.4
" R.	77	41.3		41	32.5	45	23.0
" Ja.	122	49.6		158	45.4	75	52.8
Av. Total.		70.4	38.67	58.5	31.61	43.5	27.24

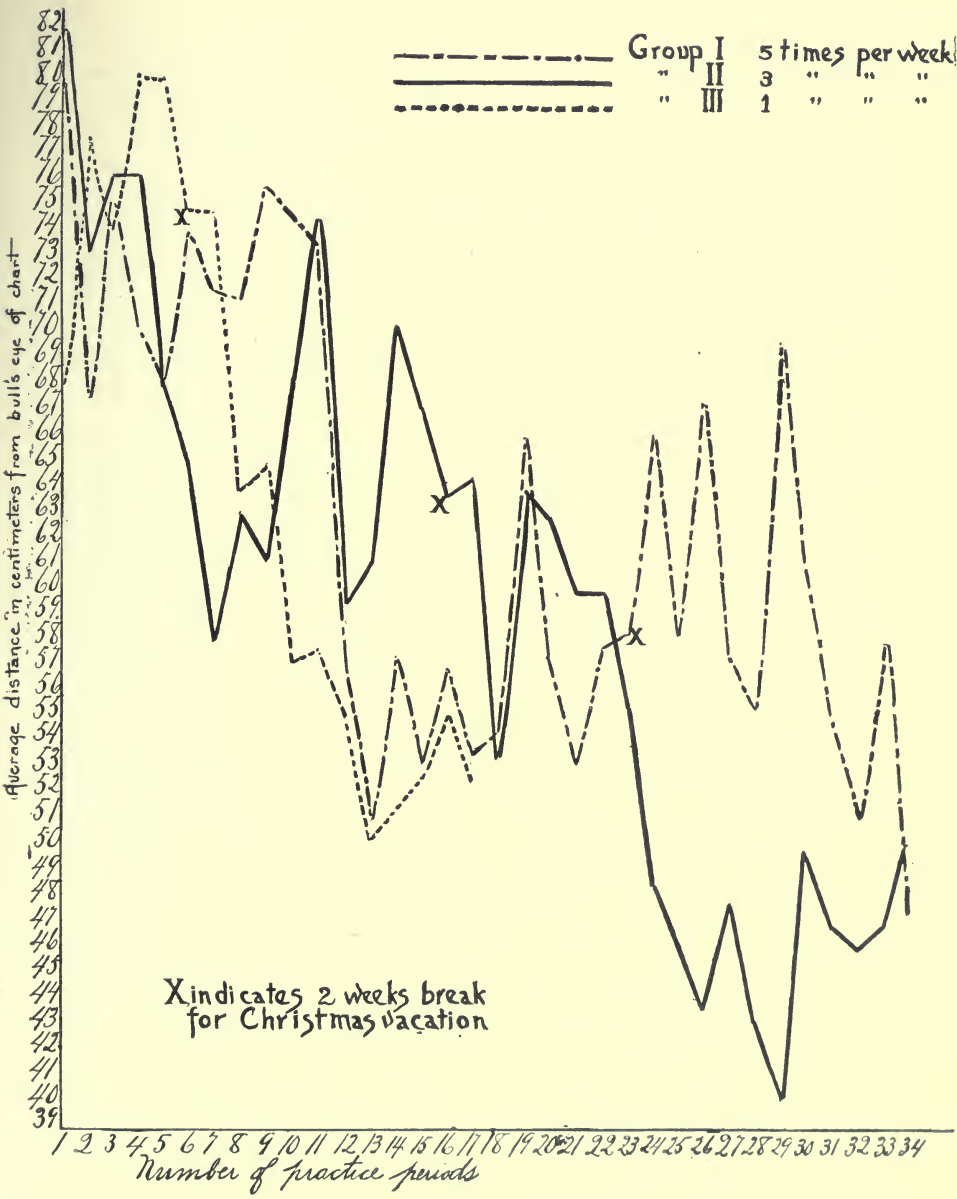


TABLE VI.
*Comparison of Average Median and Average Standard Deviation
for
the Three Groups*

	1st 50		2d 50		Last 50		Retention Test	
	Av. Med.	Av. S. D.	Av. Med.	Av. S. D.	Av. Med.	Av. S. D.	Av. Med.	Av. S. D.
Group I	67.0	39.31	50.7	32.16	48.7	31.96	50.0	32.2
" II	70.4	38.67	58.5	31.61	43.5	27.24	45.0	24.3
" III	67.7	38.26	48.2	28.65				

TABLE VII.
Junior Score

Group I		Group II	
Once per day—10 consecutive shots		Twice per day—5 shots each time	
Total score		Total score	
1. 5926	14. 3915	1. 7077	14. 4336
2. 4881	15. 3850	2. 6024	15. 4347
3. 5381	16. 3747	3. 6765	16. 4343
4. 3973	17. 4284	4. 5518	17. 4480
5. 3415	18. 3965	5. 6537	18. 4416
6. 4500	19. 4107	6. 6169	19. 4359
7. 3954	20. 3706	7. 5392	20. 4121
8. 3647	21. 4230	8. 5113	
9. 3635	22. 3591	9. 4766	
10. 4049	23. 3031	10. 4325	
11. 4331	24. 3714	11. 4029	
12. 4058	25. 3668	12. 4693	
13. 3872		13. 4010	

from the first fifty throws to the middle fifty and from the middle fifty to the last fifty throws. In both the median and deviation averages Group II led Group I, showing not only that the score was lower but that greater accuracy had been obtained by this group. The middle fifty group was composed of the fifteenth, sixteenth, seventeenth, eighteenth, and nineteenth practice periods. These periods for Group I came before the Christmas holidays and for Group II after vacation. Vacation appears to have had a pronounced effect upon Group I but very little effect upon Group II.

The progress of the girls in Group III is very marked both in their total daily average and in their accuracy as shown by the median and standard deviation made from their first fifty throws and from the middle fifty. In the last set of figures they show an improvement over both Group I and Group II. It must also be added that the middle fifty for Group III was composed of the thirteenth, fourteenth, fifteenth, sixteenth, and seventeenth

practice periods, and that of the other group was composed of the fifteenth, sixteenth, seventeenth, eighteenth, and nineteenth practice periods. A very favorable result is thereby shown in the once per week practice period. From observation of the movements and control shown, we are led to conclude that such a distribution is very effective for learning.

COMPARISON OF TEN CONSECUTIVE SHOTS PER DAY WITH FIVE SHOTS TWICE PER DAY

On Nov. 9, at 2:30 o'clock, a preliminary throw was given to 14 Junior girls. Each one threw five times. A division of the class was made in order to get seven of equal ability. The following totals show how nearly equal their first efforts were:

Group I
69.7 cm.

Group II
69.4 cm.

Group I is the group that shot twice per day at 8:30 A. M. and at 3 P. M. Group II represents those shooting once per day at 2:30. Monday, Nov. 16, Group II began regular practice and continued for twenty consecutive school days. You will note the improvement made from the first to the ninth practice. Notwithstanding the fact that at this point came five days of vacation but a small increase in score was made. There was a month's intermission from Dec. 16 to Jan. 13. Although the first practice after the pause was 4230 compared with 3706 of the last regular practice period, yet the second of the delayed series was 3591 and the third 3031, showing greater improvement after the pause.

Tuesday, Nov. 17, at 8:45, Group I commenced regular practice and threw each consecutive school day. The initial score for this group was higher than for Group II. The improvement, however, was rapid. We did not work out a table of standard deviation for this group but a comparison of daily averages will show that progress was better for those throwing but once per day. Those that threw twice daily had the advantage of a morning hour (8:30) for first trial but very little difference was noted in results from the five throws in the morning and from those in the afternoon at 3 P. M.

RETENTION TEST

Monday, March 22, a retention test was commenced for the two groups, I and II, of senior girls. Ten throws were given daily for five days to each member of the two groups. Owing

TABLE VIII.

Retention Tests

(Given March 22-25, comparing nine in each group)

			1st day	2d day	3d day	4th day
Total Score	Group I.....		5310	4830	4996	4131
"	"					
"	"	II.....	4567	4108	4813	4171
Group II						
	Med.	S. D.				
Miss S.	33	13.0				
" F.	57	21.6				
" D.	34	24.3				
" Me.	43	27.0				
" H.	39	22.1				
" Br.	49	27.0				
" St.	35	21.1				
" R.	34	18.7				
" Ja.	85	44.0				
9)409						
Ave.	45.4	24.3				
	Med.	S. D.				
Miss Hu.	34	26.0				
" He.	50	34.8				
" Hei.	45	31.0				
" La.	44	30.1				
" Sk.	60	52.7				
" Jo.	40	16.0				
" McC.	45	22.4				
" Dn.	65	34.5				
" Rn.	68	32.7				
9)451						
	50.1	32.2				

TABLE IX.

Comparison of Good Shots with Shot Following

Taken from last 50 or middle 50

(Showing 28 out of 50 shots following good shot were above median)

Good Throw	Med.	Next Throw	Good Throw	Med.	Next Throw
11	45	51	7	32	15
1	41	91	8	40	90
1	50	68	8	40	48
4	40	42	10	34	30
10	39	15	10	42	21
3	35	40	4		70
5	35	55	6	46	13
6	52	19	7	32	15
7	40	19	7	40	29
10	39	80	3	37	58
10	45	27	1	46	62
5	50	80	7	41	20
6	53	71	8	41	40
10	53	81	9	55	28
6	39	20	4	37	46
3	45	45	6	42	43
8	40	10	1	37	39
10	42	43	7	41	60
6	43	53	8	30	60
5	78	74	6	48	65
10	42	65	7	55	26
7	63	69	6	30	37
6	42	26	6	62	47
7	32	110	3	30	46
10		49			
9		124			

to the illness of several members, we could not obtain all ten girls for each day's trial, and, therefore, to make the comparison easy and just to both, we have worked out the median and standard deviation for the first four days or for forty throws for each individual, taking nine from each group. The table of these results is given on page 20. The median for Group II was 45.4 and for Group I, 50. The standard deviation for Group II was 24.3 and for Group I, 32.2.

On account of irregular practice at this period the score of one of the best performers in this group is not counted, yet the results indicate better retention for the alternate-day group. The most inefficient worker, Miss J., is counted in that test. The rest period for Group I was, however, longer by three weeks than for Group II. Had it not been necessary to close the experiment it would have been better to postpone this test several months longer.

CONCLUSIONS

From a study of the results in the above experiment, and from a careful study of the attitude of those throwing the javelin, we conclude that learning periods can be distributed by giving alternate days practice, and even weekly practice, without any loss in learning. We believe this to be a conservative statement not only for practice periods involving skill or hand manipulation but also for so-called mental work. We believe we are justified in stating that better work, for the amount of time expended, can be done in our schools through a distribution of three times per week than through a distribution of five times per week.

In the above experiment the curves did not follow the normal curve of learning to any marked degree; but those in the alternate-day group generally gave a better approximation to a regular learning curve. This is especially noted in the curve of Miss D. of Group II. If there is any scientific explanation as to why such a distribution is more economical we may find it in the suggestions of Book that conflicting associations tend to disappear in the periods of rest. We must however give some explanation of the fact that the useless arcs disappear sooner than the useful arcs. Watson gives more prominence to frequency than to any other factor in the learning process, and also lays great emphasis on the fact that thought processes affect the whole musculature of the body. During the rest periods, the subjects, no doubt,

give some thought to the practice in which they are engaged, *but only to the perfect movement they wish to make.* This may serve as suppressed practice for the useful arcs and if the period of rest is of sufficient length a greater handicap is given to the proper arc formation.

Surely something like this must explain what the psychologists mean by "attentive repetition's" being necessary for all learning. Learning is a *subtraction* process to a greater extent than an addition process. The Pauline trouble is with all learners in that it is the things we would not do that overcome the useful things. This is illustrated by the table showing the high score made after good throws. It appears that the successful throw turns loose a host of useless arcs which destroy the power of the useful connections. These unwelcome arcs are the cause of much slow learning, and longer periods of rest from those practice periods in which the useless arcs have a part is one way suggested by which we may attain more economical learning.

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COMMUNICATIONS AND DISCUSSIONS

MENTALITY TESTS

In view of the prevailing unrest in regard to the present status and the future of the Binet tests and related tests, the following extracts taken, with permission, out of a personal letter from Professor Yerkes may be of helpful interest:

"We seem to be in perfect agreement as to the direction for further work. I believe that the age arrangement of tests is wrong in principle, violating the laws of mental development. For this reason, I have to reject the age scales. Something like the Point Scale system still appeals to me as most promising, and I believe I am in agreement with you in considering the development of a number of special point scales as highly desirable.

"My present feeling is that I should like to follow out some such plan as this to test its value: (1) Develop three relatively simple scales for measuring intelligence, the application of any one of which would take not more than thirty minutes. These would consist of (a) a scale for the age range 0 to 48 months; (b) a second scale for the age range 49 to 144 months; (c) a third scale for the age range 145 months on to maturity (approximately 16 years). I have decided that it is not feasible to try to use a single point scale for all ages and that three scales constituted somewhat like the one we are now using for pre-adolescents will probably prove most feasible.

"These three intelligence scales I should propose to supplement by the development of scales for such special mental functions or groups of mental functions as (1) the receptive processes; (2) the presentative processes, possibly separating reproductive and creative imagination; (3) the ideational processes; (4) the affective processes.

"When one attempts to work out these special scales it may become evident that yet others are desirable.

"The status of my own work is this. Instead of pushing ahead with the development of the universal scale, a plan for which I announced last year, I have, with the aid of one of my assistants, developed an adolescent-adult point scale for the measurement of intelligence. This we are now trying out in a preliminary way prior to having record blanks printed. This scale requires at least an hour, and I must say that although the numerical result may not satisfactorily indicate intellectual capacity at the upper limit, the experienced psychologist obtains through the application of the scale most valuable insight into the mind of the subject.

"What a committee might do at present is extremely difficult to decide. I am most eager to see, first, the complete abandoning of all forms of the Binet scale except some such as the Stanford Revision,

and from what I have written above, you will of course perceive that I do not believe in the correctness of it. Terman has done an excellent piece of work, and I should hate much to have to say that its results should be thrown away. So, in the second place, it seems to me that a committee might, as you evidently feel yourself, attempt to develop measuring scales on the basis of psychological principles and with due care to essential points of method. Possibly it would be wise to ignore the Binet method, and on the assumption that nothing satisfactory exists, to proceed with the development of the sort of thing we think we should have.

"I am planning writing an expository and critical book on mental examining and examiners, to set forth principles and to call attention to the dangerous developments in so-called mental testing."

Psychological Examinations and Examiners: A Critique

Chapter I. Varied demands for psychological examination.

Chapter II. Psychological "testing" versus examining.

Chapter III. The history, principles, merits, and defects of the Binet method.

Chapter IV. Revisions and present status of the Binet method.

Chapter V. The history, principles, merits, and defects of the Point Scale method.

Chapter VI. Scales for the measurement of illiterates and other special groups.

Chapter VII. Modes of expressing the results of mental examinations.

Chapter VIII. Classification according to intellectual status.

Chapter IX. Descriptive psychological examining.

Chapter X. Specialized examining; the intensive study of individuals.

Chapter XI. The psychological examiner.

Chapter XII. The status of mental measurement.

The above frank statement of present point of view and immediate plans of action on the part of such an active worker and leader in this field of research, must be very valuable to those who are interested in this subject. It suggests to me the feasibility and the great need of a symposium on this subject, and I therefore take the liberty of inviting the co-operation of the workers in this field of testing to join in a symposium for which the above letter may be considered a starting-point and a good model. Now let those who have first-hand knowledge of the situation join in this effort, and let us have a simultaneous "showing of hands." Professor Yerkes has set a good example in stating (1) his present view of the situation, (2) what he is doing, and (3) what he thinks should be the next step. Let the criticism be

direct and frank with due regard to present needs and the necessity of temporizing; let each one say what he is actually doing in the use or the improvement of the tests without fear of losing caste or priority; and let each one tell what goal he sees for the immediate future of this work. Adhere to these three features and write briefly at once. Send all communications to the undersigned and they will be included in the symposium in an early number of this JOURNAL—or will go into the wastebasket.

There is need of a new generic term. "Mental tests" has a fairly understood and desirable connotation which should not be disturbed. "Intelligence tests," as now used to designate the Binet tests, is too narrow. Perhaps the expression used in the above title "mentality test" designates the Binet tests and their sequels most adequately. The main reason for the change is of course to designate the fact that the tests are more than tests for intelligence, as the affective and conative aspects must receive due recognition.

Among the problems which stand out most conspicuously for immediate consideration, the present writer sees the following:

1. Differentiation of fundamental traits. To the specific series suggested by Yerkes above, one on motor control should undoubtedly be added.

2. The flat age problem. We must find some way of stating in a really useful way in what respects a child is so many years retarded.

3. The problem of scientific scale units. The age scale has served a good purpose for pioneer work, but we must find some better scheme. What shall it be?

4. Adaptability. How can the tests be adapted to specific needs, *e. g.*, the feeble-minded, the epileptic, the criminal; for occupational guidance; or for public safety?

5. Flexibility. How can we avoid the use of specific questions for which children may be coached?

6. Approximation to the elemental. Tests are faulty in that they depend on particular information or special habits.

7. Regard for the complexity and resourcefulness of human nature.

8. Technical training. The American Psychological Association recently voted that only those who are technically trained in psychology or in the interpretation of such tests shall be trusted to use the Binet tests for diagnostic purposes.

9. Co-operation. What sort of co-operation for the development and standardizing of mental tests is now most needed?

10. Serving present needs. What form of the tests now available shall be used while awaiting further developments?

University of Iowa.

C. E. SEASHORE.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

INCLUDING EXPERIMENTAL PEDAGOGY, CHILD PHYSIOLOGY
AND HYGIENE, AND EDUCATIONAL STATISTICS

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EDITORIAL

Regular attendants on the annual midwinter meetings of the Department of Superintendence and affiliated societies could not fail to be impressed with the degree to which
THE DETROIT MEETINGS mental tests and educational measurements have increased in prominence on the programs and in the discussions of the members. Three years ago at the Philadelphia meeting, when the preliminary report on educational measurements was made to the National Council, the idea of scientific measurement in connection with educational procedure was so novel that it was with some difficulty that its advocates could gain a hearing. At the Detroit meetings the value of mental and educational tests was so clearly recognized as to leave no doubt that practical educators are looking in this direction for help in the solution of their problems.

On Monday evening the meeting of the National Society for the Study of Education was given over entirely to "Tests and Standards of Efficiency in Schools and School Systems." The program was made up of ten minute addresses by the members of Professor Strayer's committee on such topics as The General Significance of Tests, the

Derivation of Scales in School Subjects, the Work of the Bureau of Research and Efficiency, the Use of Standards and Tests at Salt Lake City, the Value of the Curtis Tests in Arithmetic to Superintendents, Standard Tests as Aids in the Classification and Promotion of Pupils, Completion Tests for Public Schools, and the Use of Mental Tests in the Schools. While it was freely admitted that educational testing was still in its infancy, much optimism was expressed as to its results, both from the point of view of school administration and from that of increasing the efficiency of teaching.

On Tuesday morning half of the session of the National Council was devoted to the same topic—"Tests and Standards of Efficiency"—with such speakers as Professors Strayer, Judd and Baldwin, President Withers, and Superintendents Bliss and Chadsey. On Thursday afternoon the round table of directors of educational research provided opportunity to hear the views of the men professionally engaged in research work in the public schools. Various phases of educational research were considered, as the standardization of teachers' examinations, the application of intelligence tests to elementary school pupils, and the improvement of instruction through educational measurement. At the first meeting of the College Teachers of Education the question of the relation of college and university departments of education to other agencies which have to do with the scientific study of education was discussed by Professors Jessup and Strayer for the universities, by Directors Ballou and Curtis for the city departments of educational research, and by Dr. Ayres and Mr. Flexner for the educational foundations. It seemed to be the consensus of opinion that the initiative in educational research would rest largely with the colleges and universities, that the city bureaus of research were forced to heed the demands of their constituents for immediate results, and that the great foundations could do splendid service by undertaking investigations extending over wide areas and co-ordinating the sporadic and local studies of other agencies.

Two other important features of the meetings were the debate of Director Charles H. Judd, affirmative, and President Carroll G. Pearce, negative, on the proposition "The Best Organization for American Schools is a Plan which shall Divide these Schools into Six Years of Elementary Training and Six Years of Secondary Training"; and the joint discussion of "The Minimum Essentials versus the Differentiated Course of Study in the Seventh and Eighth Grades," between Professors Lotus D. Coffman and William C. Bagley defending a common core of minimum essentials and Superintendent John D. Shoop and Commissioner David Snedden advocating separate courses of study.

J. C. B.

NOTES AND NEWS

The City of Chicago through the co-operation of the school board with the special park commission will have its already excellent system of public playgrounds almost doubled this year. Forty-six new public playgrounds are to be opened this spring. The school board furnishes the ground and allows certain privileges with reference to the use of a portion of the school buildings after hours, while the special park commission keeps the playgrounds in condition, supplies the apparatus, and pays the salaries of the instructors. It is estimated that the average expenditure for each playground is between \$8000 and \$10,000.

After extended preliminary experimentation the police department of New York City has established a laboratory at police headquarters for the purpose of examining prisoners to detect those who are mentally defective. The laboratory will be in charge of Dr. Louis Bisch.

The *Journal* of the American Medical Association states that the minister of justice has appointed a commissioner to study crime in Chile and to report to the government his recommendations for measures to prevent crime, reform delinquents, and for the classification and separation of prisoners. A laboratory of experimental psychology is to be established in the penitentiary at Santiago, and physicians in penal institutions will be required to furnish information or data in connection with the work.—*Science*.

The Cincinnati school board has been conspicuous in broadening the outlook of public school teachers and enabling them to come in contact with other school systems. Arrangements were made for a temporary exchange of teachers with various cities in this country and in South America, and for giving leaves of absence with part pay to teachers who desire to pursue advanced studies in home and foreign universities. Unfortunately this enlightened policy has been dealt a severe blow by the action of the attorney general of the state, who has recently ruled that such acts involve an illegal use of the school funds.

There will be opened in affiliation with the Carnegie Institute of Technology, Pittsburgh, on June 1, 1916, a Bureau of Salesmanship

Research. A fund amounting to \$75,000 for the support of the Bureau for the first five years has been provided by a group of business concerns to whose initiative the organization of the Bureau is due. Among these co-operating concerns are the Westinghouse Electric and Manufacturing Company, the H. J. Heinz Company, the Armstrong Cork Company, the Equitable Life Assurance Society, the Ford Motor Company, the Carnegie Steel Company, and others. Offices, psychological laboratories and equipment have been provided by the Carnegie Institute of Technology.

The aim of this Bureau is to secure a broader basis of established fact for use in improving present methods of selecting and training salesmen, by accumulating and systematizing information concerning the methods now used by successful firms, by applying psychological tests to the analysis of the mental traits of successful and unsuccessful salesmen, by carrying on experiments in the selection and training of salesmen in co-operation with various firms, and by publishing the results of these studies through appropriate channels.

The activities of the Bureau will be guided by a scientific staff, on which Dr. W. D. Scott, Professor of Psychology in Northwestern University, serves as Director, and Professors W. V. Bingham (Carnegie Institute of Technology), J. B. Miner (Carnegie Institute of Technology), and G. M. Whipple (University of Illinois), will serve as co-operating psychologists. The scientific staff will comprise, in addition to the foregoing, a research assistant and several research fellows. The fellowships, yielding from \$300 to \$500, will be awarded to graduate students of superior intellectual ability, personality and leadership, who intend to fit themselves for careers as employment managers and supervisors of personnel. There will be opportunity also for students of psychology who wish to prepare doctors' dissertations in the fields of mental tests, vocational analysis, statistical method, etc. Inquiries may be addressed to W. V. Bingham, Carnegie Institute of Technology, Pittsburgh, Pa.

The spelling test recently made by Dr. David Spence Hill on 25,000 New Orleans elementary school children from the third to the eighth grades has been completed and tabulated. The tests used were the Ayres lists as employed in Springfield, Ill., and other cities. The general average of New Orleans white children was 74.9 per cent.,—almost five per cent. higher than the 70 per cent. standard set by Ayres. The scores by grades were as follows: Third grade, 65.2 per

cent.; fourth, 76.3 per cent.; fifth, 79.5 per cent.; sixth, 79.2 per cent.; seventh, 77.6 per cent.; eighth, 74.2 per cent. The girls were uniformly superior to the boys, their scores exceeding those made by the boys in each grade from the third to the eighth, as follows: 5.1, 6.4, 3.8, 5.1, 2.5, 2. The 3677 colored children tested averaged 71.9 per cent. The tabulation of the misspellings of specific words in the various grades shows striking variations of difficulty, many of which are not in accord with the ordinary judgments of teachers. Further investigations are being made of the over-lapping of grades in spelling ability, of the relative values of sentence and column tests, and of the relationship between age-grade status and spelling accomplishment.

The first number of the new *Journal of Experimental Psychology*, under the editorship of Professor John B. Watson, Johns Hopkins University, has just been issued. While the editor makes no specific statement as to the policy of the journal, it is evident from the contents of the initial number that the term experimental psychology is to be taken in a broad sense, and that work in mental tests and perhaps even in educational measurements is not to be excluded. In addition to articles on color photometry, on tonal volume, and on the conditions of attention, the present number contains the following articles that will be of especial interest to educational psychologists: "A Graded Series of Geometrical Puzzles" by Grace H. Kent, based upon the Binet divided rectangle; and "Relative Values of Point-Scale and Year-Scale Measurements of One Thousand Minor Delinquents," by Thomas H. Haines. The *Journal* is published by the Psychological Review Company, Princeton, N. J., and the subscription price is \$3.00 per year.

Announcement is made of the establishment of a new *Journal of Delinquency*, devoted to the scientific study of problems related to social misconduct, under the managing editorship of Mr. J. Harold Williams, director of the department of research at the Whittier State School, Whittier, Cal. The *Journal* will be published bi-monthly by the school, at the subscription price of \$1.25 per year, and Mr. Williams has enrolled as co-workers some of the most eminent students of delinquency in the country.

The Health Messenger, whose volume I, number 1 appeared in February, 1916, is an experiment in co-operation between the vocational interests and the health interests of the public school system of

the city of Albany, N. Y. *The Messenger* is to be issued monthly during the school year by the Albany School of Printing, and the material is to be furnished by the staff of the health director of the city schools. The aim of the publication will be to keep pupils and parents informed of the work that is being done to secure public health, and to enlist their sympathy and co-operation. Dr. Clinton P. McCord, Health Director, is responsible for the enterprise.

The Association of Modern Foreign Language Teachers of the Central West and South proposes the establishment of a *Modern Language Journal* to further the study and teaching of modern foreign languages in American secondary schools and colleges. The president of the Association is Professor Arthur G. Canfield, of the University of Michigan.

Bates College has received \$15,000 towards the endowment of a chair of education.—*School and Society*.

The third annual conference on Educational Measurements will be held at the University of Indiana April 14 and 15, 1916. The speakers from abroad will be Dr. B. R. Buckingham, educational statistician for the State of Wisconsin, and Professor Ellwood P. Cubberley, Leland Stanford University. Dr. Buckingham will speak on "Principles of Scale Derivation with Special Application to Arithmetic, Geography, History and Grammar"; and "Efficiency Indices." Professor Cubberley will speak on "The Significance of Educational Measurements"; "Standard Tests in the Work of School Administration"; and "Measurements Applied to School Financing." In addition Dean W. W. Black will make a "Report on Writing," Professor M. E. Haggerty, now of the University of Minnesota, will report on "Measurement of Reading," Mr. J. Z. A. McCaughan will give a "Preliminary Report on Algebra Tests," Professor E. H. Lindley will speak on "Standardization of Methods of Grading the Pupil's Work," and there will be practical demonstrations in giving and scoring standard tests in algebra, arithmetic, composition, reading and writing.

At the Detroit meetings of the Department of Superintendence and affiliated societies Mr. John D. Shoop, superintendent of schools of Chicago, was elected president of the Department of Superinten-

dence, Superintendent Charles E. Chadsey, of Detroit, president of the National Society for the Study of Education, and Dean Will Grant Chambers, University of Pittsburgh, president of the Society of College Teachers of Education. The next meeting will be held at Kansas City.

The following is translated from the *Breisgauer Zeitung*: "The well-known philosopher Privy Councillor Oswald Külpe, professor of philosophy and psychology, and director of the Psychological Institute at the University of Munich, died after a short illness at the age of fifty-three years. With him the world has lost one of the most thorough-going investigators in the field of experimental psychology and psychophysics, in the technique of which he had few equals, and at the same time a penetrating student of epistemological and metaphysical problems."

Bernard Cronson, principal of the public school in Ninety-ninth Street, between Second and Third Avenues, New York City, died on February 1, aged fifty-one years. He introduced into his schools systems of pupil self-government, school newspapers and pupils' lunch systems, and carried out other social work among his pupils. He had been president of the Principals' Association and was the author of "Graded Lessons in Punctuation," "Graded Dictation and Spelling," "Methods in Elementary School Studies," "Pupils' Self-government," and "The Philosophy of Common Fractions and Square Root."—*School and Society*.

Professor J. Carleton Bell, of the Department of Education, University of Texas, recently delivered an address before the students of psychology and education at the University of Iowa on the subject "The Significance of Mental Tests for College Students."

During the first part of February Professor M. V. O'Shea of the University of Wisconsin accepted an invitation extended by the masters and trustees of St. Paul's School, Concord, New Hampshire, to make a study of the curriculum and methods of teaching improvement. He spent some time at the school, and held daily conferences with the faculty for the discussion of his findings.

Professor William Stern, professor of psychology at the University of Breslau, known for his work on differential psychology and on mental tests, has been called to Hamburg to take the position formerly held by the late Professor Ernst Meumann.

Professor Truman Lee Kelley, University of Texas, will give courses in educational psychology and mental tests at the summer session of the University of Washington.

Professor Raymond Dodge, of Wesleyan University, recently elected president of the American Psychological Association, has been appointed non-resident lecturer in psychology at Columbia University for the academic year.—*School and Society*.

Dr. David Snedden, commissioner of education for Massachusetts, has accepted a call to a professorship in educational administration at Teachers College, Columbia University. Professor Snedden will specialize in the administration and supervision of vocational education.

Dr. J. L. Henderson, professor of secondary education at the University of Texas, will give courses in high school curricula and the preparation of teachers for secondary schools at the summer session of Teachers College, Columbia University.

Francis N. Maxfield, Ph. D., assistant professor of psychology at the University of Pennsylvania, delivered two lectures on December 11, before the Teachers' Institute at Lancaster, Pa., on "Intelligence Tests Useful for Grade Teachers," and "The Public School Room and Juvenile Delinquency." He also conducted clinical work at the special school of the city.—*School and Society*.

A CORRECTION.

The attention of readers of the JOURNAL is called to a typographical error in the title of Professor Seashore's paper in the February issue. The title should have been "Elemental Tests," not "Elementary Tests."

CURRENT PERIODICALS

ZEITSCHRIFT FUER ANGEWANDTE PSYCHOLOGIE UND PSYCHOLOGISCHE SAMMELFORSCHUNG. Vol. VIII. 1914. PAUL ANDREAS WAGNER. *Das freie Zeichnen von Volksschulkindern.* 1-70. The article, which is richly illustrated with children's drawings, discusses first the number and kinds of details chosen by 1500 pupils from six to eighteen years of age to illustrate the story *Schlaraffenland*. There are seventeen of these details or motives, and the results are classified separately for boys and girls and for the different school grades. There is an extended discussion of the drawings expressing humor and motion, and of those portraying the human form. The author thinks that the introduction of modern methods of teaching drawing will decidedly enhance the quality of children's drawings in schools.

A. HOFFMAN. *Vergleichende Intelligenzprüfungen an Vorschülern und Volksschülern.* 102-120. From a total of 550 pupils in ten classes 156 were chosen for examination. These consisted of groups of thirty to thirty-five children from each of the two schools of the ages of seven and nine, and a group of twenty-nine children ten years old from the fourth class in the *Volksschule*. These 156 pupils were given the Binet tests for the sixth, seventh, eighth, and ninth years; and a detailed discussion of the showing made by each class of pupils in each of the tests and a comparison of the results for the two types of schools are given. Professor Stern discusses these results in a subsequent article, and points out that the striking superiority of the *Vorschule* pupils (from one half to a whole year of mental age) should not be used as an argument in favor of inferior school advantages for the pupils of the public schools, but holds rather that the best education available should be made accessible to all classes of children.

H. SCHIEFLER. *Zur Psychologie der Geschlechter: Spielinteressen des Schulalters.* 124-144. This study is based on the play interests of 1242 boys and 1166 girls from the ages of seven to fourteen. Tables and plates show the rise of certain types of play interests and the decline of others. These plays are taken up under the headings of imitative plays, plays involving bodily movement and contest, plays of mental activity and contest, and occupational plays, such as collections, playing on musical instruments, with animals, fishing, etc. The author rejoices to find that coeducation has no effect on children's plays.

SYDNEY ALRUTZ. *Zur Psychologie der Taschenspielerkunst.* 181-192. The author calls this the first chapter in the history of the psychology of report. He examines very carefully the reports of the performances of noted prestidigitators that occupied the attention of scientific men in London about 1880 to 1887. The author's sources are particularly the reports to be found in the proceedings of the Royal Society.

STEFAN VON MADAY. *Die Fähigkeit des Rechnens beim Menschen und beim Tiere.* 204-227. The author gives an interesting sketch of the history of arithmetical computation by animals, sums up the observations that have been made on the beginnings of number in children, discusses the relation between arithmetical ability and intelligence, and raises the question whether horses can learn arithmetic. There is a bibliography of twenty-eight numbers.

L. M. KLINKENBERG. *Ableitung von Geschlechtsunterschieden aus Zensurenstatistiken.* 228-266. This study of sex differences on the basis of school marks is introduced by a description of the organization and course of study of the Dutch *Oberrealschule* and a comparison of this with the German schools. There is a discussion of the formulae used in the computation of sex differences, a consideration of the distribution of marks and a comparison between two groups of girls, one in a girls' school and one in a mixed school. The author finds girls not so well adapted as boys to the thought processes of mathematics, geography, and history. The girls in the lower classes show greater industry, and therefore somewhat higher grades. In the middle classes the differentiation begins to show itself in special subjects, the girls gradually drawing ahead in language work, the boys in scientific subjects.

E. D. WIERSMA. *Intelligenzprüfungen nach Binet und Simon und ein Versuch zur Auffindung neuer Tests.* 267-275. A report on the application of the Binet tests in Groningen. The new tests consisted of the application of Burt's dotting apparatus and concentration of attention test, the construction of new words from a given number of letters, an imagination test, a picture puzzle test, and a recognition test.

G. FR. MUTH. *Ornamentationsversuche mit Kindern. III. Ueber Alters-, Geschlechts- und Individualunterschiede in der Zierkunst des Kindes.* 507-548. A continuation of the development of ornamentation in children on the basis of personal observation of the drawings of two young children and of over two hundred school children from the sixth to the thirteenth year. The girls are distinguished by the great skill and delicacy of their work; and in the higher grades, are able to indicate the contrast between animate and the inanimate portions of a picture. The boys, on the other hand, show much rougher work, but are frequently more original. Often the value of the boys' work is determined by characteristics which lie quite outside the ornamental. The author traces an interesting parallel between phylogentic and ontogentic development in ornamentation.

Vol. IX. 1915. HANS RUF. *Ueber die Prüfung musikalischer Fähigkeiten. Teil I.* 1-77. The first twenty-five pages of this study of musical capacities deal with methods of testing for absolute pitch. There follows a discussion of auditory discrimination, the recognition of successive and simultaneous intervals, melody, harmony, time, and rhythm. The last three chapters are illustrated by numerous examples particularly from the singing of children.

JOHANNES HABRICH. *Ueber die Entwicklung der Abstraktionsfähigkeit von Schülerinnen.* 189-244. An experimental study of the development of abstraction in seventy-two girls from various classes in the *Volksschule*. The essential point in the experiment was the correct recognition of similar groups of objects. The procedure of Koch is closely followed and the results obtained are compared with those previously secured from boys of the same group. The boys throughout show a higher degree of efficiency. The difference between the sexes increases with age. The author states that the easier tasks are better performed by the girls than the boys, but as the tasks become more difficult, the boys leave the girls far behind.

MAX LEVY-SUHL. *Der Zweck der Strafe in der Auffassung jugendlicher Angeklagter.* 245-267. In this article an effort is made to determine what adolescent delinquents think is the purpose of punishment. One hundred thirty-six persons are studied, ranging between the ages of twelve and eighteen years. The answers are grouped into two classes; first, it brings about a betterment of the evil-doer, so that he will not commit further misdeeds; and second, it is a general restraint and warning to others not to break the law. The answers are tabulated in detail along with the grade of intelligence and the delinquency of each individual.

EMMY SECKEL. *Ueber die Beziehung zwischen der Beliebtheit und der Schwierigkeit der Schulfächer.* 268-277. Over 250 pupils ranging from nine to twenty-one years of age were asked to indicate the hardest subject, the easiest subject, the subject liked best, and the subject liked least. The results are tabulated and discussed subject by subject. The German language is the favorite subject and is also found easy. Mathematics is generally considered difficult and is frequently disliked.

KAETHE UND ADOLF BUSEMANN. *Ueber die Entwicklung der Merkfähigkeit bei Schulkindern.* 277-279. In a study of memory span series of ten monosyllabic words were read aloud three times to the children, the first word of the series was then given them, and they were asked to reproduce the remainder. The children ranged from 8 to 14 years of age and included 245 boys and 242 girls. The span ranged from 3.4 words in the eighth year to 7.9 in the fourteenth year. The girls surpassed the boys at every age.

O. KOSOG. *Die Wertung der Testserien.* 280-298. A critical examination of the Binet tests on the basis of their application to the author's five year old boy. The boy tested somewhat over nine years in mental age, but from other evidence of the child's mental ability the author concludes that this only proves that the Binet tests for the lower ages are too easy. The author repeats Stern's warning against over-rating the diagnostic value of the tests.

HANNA NEUGEBAUER. *Aus der Sprachentwicklung meines Sohnes.* 298-306. A detailed account of the linguistic difficulties of a child in the second and third years, and of the expedients to which he resorted in expressing his ideas.

ALFRED MANN. *Zur Psychologie und Psychographie der Aufmerksamkeit.* 391-479. A detailed analysis of the factors that enter into attention, and an elaborate psychogram of the attention of a single individual. While the study has particular reference to adults, the fundamental idea of a complete map, so to speak, of a pupil's attention processes is important for education, and although the scheme developed in this article could not be used in its entirety with children, it might furnish a basis for an analysis that would be feasible for school diagnosis.

MARGARETE HOFFMANN UND BETTY REICH. *Vergleichend-psychologische Untersuchungen über Aufsätze von Schülern und Schülerinnen der Volksschule.* 480-512. Compositions were secured from the four upper classes of four different schools on the three subjects "Das Wiedersehen" (The Return), "Warum uns der Winter gefällt" (Why we like Winter), and "Was ich tun möchte, wenn ich gross sein werde" (What I should like to do when I grow up). About 2400 compositions were thus secured from 800 children. The present article gives a preliminary report of an analysis of certain phases of compositions on the second and third of these subjects. The results are so arranged as to bring sex differences into as high a light as possible. In the analysis emphasis is laid on the psychological characteristics revealed in the compositions rather than on their pedagogical or stylistic excellence.

ERNST BLOCH UND HEDWIG LIPPA. *Ueber Wiederholung der Binet-Simon'schen Intelligenzprüfungen an schwachsinnigen Kindern nach einem Jahre.* 512-515. Of the 53 children re-examined by the 1908 Binet tests after the lapse of one year only 35 had any recollection of the previous tests, and these recalled nothing more than that pictures and money were shown. Six children showed an increase of two years in mental age, twenty-three of one year, ten of one-half year, and fourteen no increase at all.

PUBLICATIONS RECEIVED

LEONARD P. AYRES AND MAY AYRES. *School Buildings and Equipment*. Cleveland Education Survey, 1916. Pp. 117. 25c.

There are four factors that make for advancing standards in school-house construction. These are changes in educational methods, consideration of the safety of school children, care for health, and the endeavor to increase the happiness of school life. This little book gives a brief sketch of the development of school house construction from 1850 to the present day, the fundamental conditions which determine the location and construction of the school plant, the cost per pupil per class-room and per cubic foot, and the problems confronting boards of education in modernizing old buildings and in providing new ones.

W. B. DRUMMOND. *The Child, His Nature and Nurture*. New York: E. P. Dutton and Company, 1915. Pp. viii, 223. \$1.00.

This is an enlarged and revised edition of the author's little book which was originally published as one of the Temple Primers. The book contains chapters on the care of the infant, the growth of the child, the senses, the muscles, the emotions, the intellect, the will, habit, and Froebel and the kindergarten. Two new chapters have been added, the first dealing with "Children who Never Grow up," based especially on Goddard's recent studies of the feeble-minded, and "The Montessori Method." The style is simple and easy almost to the extreme. While the author claims to have brought the discussion up to date, there is little indication of any notice of the experimental studies that have been carried on in both England and America in the past five years.

MICHAEL F. GUYER. *Being Well-Born*. Childhood and Youth Series. Indianapolis: The Bobbs-Merrill Company, 1916. Pp. 374. \$1.00.

The author's intention in this volume is to examine into the natural endowments of the child, and since full comprehension of it requires some understanding of the nature of the physical mechanism by which hereditary traits are handed on from generation to generation, a small amount of space is given to this phase. Then, that the reader may appreciate to their fullest extent the facts gathered concerning man, a review of the more significant principles of genetics as revealed through experiments in breeding plants and animals has been undertaken. The main applications of these principles to man is pointed out in a general discussion of human heredity. Finally, inasmuch as all available data indicate that the fate of our very civilization hangs on the issue, the work concludes with an account of the new science

of eugenics which is striving for the benefit of the race by determining and promulgating the laws of human inheritance so that mankind may intelligently go about conserving good and repressing bad human stocks. Among the most interesting chapters are those on "The Responsibility for Conduct," in which the dependence of our behavior upon the inherited structure of the nervous system is emphasized, and "Crime and Delinquency," in which the problems of the feeble-minded, the criminal, and the degenerate are considered from the biological point of view.

WILLYSTINE GOODSSELL. *A History of the Family as a Social and Educational Institution*. New York: The Macmillan Company, 1915. Pp. xiv, 588. \$2.00.

We have here a very scholarly and thorough treatment of the subject of the family as an educational influence. The introductory chapter emphasizes the recency of the historical study of the family and its importance from the genetic point of view. Subsequent chapters discuss the primitive family; the patriarchal family, as exemplified in the life of the Hebrews, the Greeks, and the Romans; the influence of early Christianity upon the status of woman, marriage, and family legislation; the family in the middle ages; the family during the renaissance; the English family in the 17th and 18th centuries; the family in the American colonies; the industrial revolution and its effect upon the family; the family during the 19th century; the present situation; and current theories of reform. In discussing the present situation, the author surveys the forces that make for the instability of the family, such as divorce, desertion, and the disintegrating influence of industrial conditions, and pays especial attention to the problems of the marriage rate and the birth rate. Especially deplorable is the condition of the family amongst the more intellectual classes, such as college graduates. "If the size of family of college graduates should continue to decrease as it did during the 19th century, students graduating in 1935 would have no children at all." The final chapter presents in some detail the various plans proposed to alleviate the situation. The radicals hope to bring about reform by opening all occupations to women and by making wages equal for women and men. Women are to be economically independent and thus join with men as equals in the founding of homes. The conservatives on the other hand adhere to the traditional conception of the home and of the sphere of woman and believe that the division of influence is in accord with biological evolution. The author seems to favor the views of the moderate progressives, which call for the revision of domestic codes and the passage of laws for the protection of women and children. In the final analysis a campaign of education is needed to quicken the minds of young men and women with reference to their social and biological duty in relation to each other and to the future of the race.

MARTIN HEGLAND. *The Danish People's High School, Including a General Account of the Educational System of Denmark.* Bulletin 1915, No. 45. Washington: Bureau of Education, 1915. Pp. 179. 20c.

The Danes believe thoroughly in training, and every inducement is held out to the youth to attain proficiency. Their ideal is first to lay a foundation with as good a general education as the parental means and the child's capacities allow. There is an opportunity to complete a course of general training at almost any year in the young person's life, but this general education has undergone striking changes within the last few years and the influence of modernism has been so strong as to cause an almost complete break with the Greek and Latin requirements of an earlier day. The preponderance of weight even in the gymnasia is now upon modern languages and upon subjects of more or less definite practical utility.

DAVID JAYNE HILL. *The People's Government.* New York: D. Appleton and Company, 1915. Pp. xv, 287. \$1.25.

In every generation there is need of examining anew the foundations of government. At the present time this duty is more imperative than usual, for we have recently been passing through a period of criticism upon our institutions that has created in some quarters an unwarranted depreciation of their value; in others a genuine solicitude for their preservation. There are three concepts—the state, the law, and the citizen—that are fundamental to the realization of any high ideal of human society. Beginning with the state as an embodiment of force, we trace its development as a human ideal. We see it long dominated by law, regarded as a sovereign decree, until this conception has been superseded by the idea of law as mutual obligation. Finally we see the rights of the citizen as lawmaker and as subject to law and it is in the citizen that we find the solution of the problem of human government and of the co-ordination of human governments in the world organization of humanity. The book challenges the thought of every serious-minded reader, and offers much material for teachers of civics in the public schools.

WALTER S. HINCHMAN. *The American School.* New York: Doubleday, Page and Company, 1915. Pp. xii, 232. \$1.00.

"The main purpose of this book is to interest the parent quite as much as the teacher in the problems which confront American secondary schools. Americans pay more for their education than any people in the world and though it may seem to the educator that they might reasonably pay yet more, it is not so much to the point to urge greater appropriations as to show what education may do, and to interest the citizen in the problems connected with it. He will not

be likely to appreciate the importance just because he pays high for it; but he will be ready to pay high for it if he appreciates its importance, and the great thing above and below all is that he shall appreciate its importance, for no system of education can relieve him of his office as chief teacher of his children." Among the problems discussed are the general significance of education, the pupil in relation to the school, the activities of the teacher and the difficulties of securing the right kind of teacher, the course of study, and the methods employed in teaching.

EDWIN B. HOLT. *The Freudian Wish and Its Place in Ethics*. New York: Henry Holt and Company, 1915. Pp. ix, 212. \$1.25.

"Freud's contribution to science is notable and in my opinion epoch-making for a reason which has hardly ever been mentioned, and this reason is that . . . he has given us a key to the explanation of mind. It is the first key that psychology has ever had which fitted and moreover I believe that it is the only one that psychology will ever need. This key to the mind, which Freud calls the wish, is the subject of the present volume." One of the most interesting chapters in the book is the physiology of wishes and their integration, in which the author skillfully pilots us through the devious ways of modern behaviorists and shows how the wish is the culmination of all forward projections of experience. The book is a stimulating and fruitful contribution to the Freudian literature.

HELEN B. HUBBERT. *The Effect of Age on Habit Formation in the Albino Rat*. Behavior Monographs. Vol. 2. No. 6. Serial No. 11. New York: Henry Holt and Company, 1915. Pp. 55.

In experiments with the circular maze the author finds that young rats learn more rapidly than old ones, and that the rapidity with which the habit may be formed decreases with increase in age. In very old and very young rats sex differences are negligible, while in those of medium age the males learn more rapidly than the females. Daylight and dark make no difference in the formation of the maze habit. Heredity seems to play a considerable part in the rate of learning, as the rapidity with which the maze habit may be formed is predictable within certain limits from one family group to another.

HENRY JOHNSON. *Teaching of History in Elementary and Secondary Schools*. New York: The Macmillan Company, 1915. Pp. xix, 497. \$1.40.

With the increasing appreciation of the significance of history in both elementary and secondary education, there is a distinct need for a volume of this sort to examine the fundamental principles of the teaching of history. It is the author's aim to present as concretely as possible the fundamental conditions for making history of any

kind effective in the school room. An introductory chapter on what history is leads to the problem of grading history, which is essentially a problem in presentation. The author believes that history of any kind, even scientific history, can be taught almost at any stage of instruction on the simple condition that it is taught in a sensible way. There follow chapters on the aims and value of history, on the treatment of history in European schools, history in American school curricula, the biographical approach, the study of social groups, making the past real, the use of models, pictures and maps, textbooks and their use, collateral reading, school history and the historical method, the correlation of history with other subjects, and the history examination. There is a bibliography of 34 pages.

- R. O. JOHNSON. *Measurement of Efficiency of Schools Established for the Deaf*. Report of Progress of the Committee on Research Appointed by the Conference of Superintendents and Principals of American Schools for the Deaf. Philadelphia: 1915. Pp. 18.

The report contains an account of educational tests for the deaf, and abstracts of addresses delivered by Henry H. Goddard on "Testing the Intelligence of Children and the Binet Simon Scale"; by A. Duncan Yocum on "Educational Development and Courses of Study"; by Bird T. Baldwin on "A Psycho-etiological Study of Meningitis and Educational Development"; and by G. Hudson MacKuen on "The Physiology and Psychology of Hearing with Special Reference to the Development of Speech."

- R. O. JOHNSON. *Statistics concerning Deafness*. Extract from the Seventieth Annual Report of the Indiana State School for the Deaf, 1915. Pp. 28.

This pamphlet presents the statistics of cases received at the Indiana State School for the Deaf for the past seventy years. Among other data recorded are the ages at which deafness occurred, the causes of deafness, the degrees of deafness, the classification of deafness, the intermarriage of the deaf, and the relation between hearing and speech.

- H. D. KITSON. *Psychological Tests for Lip-Reading Ability*. Volta Review, Vol. 17, No. 12. December 1915. Pp. 471-476.

"How long will it take me to become a good lip-reader?" This is the question that frequently confronts the teacher of the deaf. The author employed two tests, a test of perception, using Whipple's tachistoscope, and a completion test, and compared the ranking in these tests with ability in lip-reading. The sum of the ranks in the two tests compared with the rank in lip-reading gives a correlation coefficient of .80.

HERBERT G. LULL. *A Survey of the Port Townsend Public Schools.* Bulletin of the University of Washington: University Extension Series No. 17. Seattle: August 1915. Pp. 112.

The survey presents a general account of the administration of education in the district, a more careful study of the details of supervision, graphs representing school census enrollment, average attendance, number of teachers, high school graduates, and teachers' salaries for the past ten years or more. In the examination of the course of study and the quality of instruction, the Ayres' tests for spelling were given according to the Springfield, Ill., procedure; the handwriting was measured by the Thorndike scale; the work in arithmetic was determined by means of the Courtis standard tests and the Stone reasoning problems; Starch's reading tests were carried through the elementary grades, and the pupils' compositions were rated with the help of the Harvard-Newton scale. The results, presented in the forms of tables and graphs, constitute norms for further studies.

MELVIN ALBERT MARTIN. *The Transfer Effects of Practice in Cancellation Tests.* Archives of Psychology, No. 32, August 1915. Pp. 68. 60c.

In his introduction the author raises the question under what conditions, to what extent, and in what direction may we expect training of a special kind to produce transfer effects? While the experiment is limited to a narrow field (the effects of prolonged practice in cancelling in one situation upon cancelling in another situation), the materials and methods were such as to ensure exact quantitative scoring. Among the conclusions which the writer draws are the following: The extent and direction of the transfer effects depend upon the practice situation, upon the test situation, and upon the relation between them. When the two situations are much alike, the transfer effect is largest and in a positive direction. When the two situations are widely different there is interference, that is, the transfer effect is large and negative. When the test situation contains none of the content elements of the practice situation, but is such that the task performed is somewhat similar as to form with that of the practice, the transfer effects are negative, causing a decrease in accuracy.

CLARENCE ARTHUR PERRY. *Educational Extension.* Cleveland Education Survey, Cleveland, Ohio, 1916. Pp. 115. 25c.

School extension, or the wider use of the school plant, has taken a very firm hold upon American education. This little volume will be of distinct value to those engaged in this work, or to those who are desirous of taking it up, since it presents in convenient form not only what is being done in Cleveland but what some of the most progressive cities are doing to utilize their school plant.

Report of the Commissioner of Education for the Year ending June 30, 1915. Vol. 1, Washington: Bureau of Education, 1915. Pp. 780.

This volume contains a useful survey of educational legislation in 1915, accounts of education in larger and smaller cities and in rural communities, secondary education, higher education, the training of teachers, medical education, vocational education, kindergarten education, school surveys, education in Latin America, and in many of the leading European countries. The chapter on school surveys gives a condensed but representative account of the chief investigations undertaken during the last few years.

The Rockefeller Foundation. Annual Report, 1913-14. New York: Published by the Foundation, 1915. Pp. 226.

This report gives an account of the International Health Commission with its work in tropical countries, its investigation of industrial relations in New York City and other places, its work on mental hygiene, its efforts for the relief of suffering Belgium, its promotion of missions, and its medical work in China.

MIRIAM FINN SCOTT. *How to Know your Child.* Boston: Little, Brown and Company, 1915. Pp. x, 316. \$1.25.

The aim of this book is to interpret children to their parents, to try to help parents to see the vast riches, hitherto but dimly seen or perhaps not perceived at all, which exist unutilized in their children, and to try to help parents recognize and develop this wasted human wealth. The book is written in an easy conversational style, and contains interesting chapters on the study of individual children, the nature of disobedience and the responsibility of parents for it, unspoiling the spoiled child, what to play and how to play it, children's clothes, and the relation between children and their father. While the book offers nothing that is new or scientific, the trenchant way in which many shortcomings of parents are attacked makes it worthy of high commendation.

Second Report on Fifty-two Border-line Cases in the Rome, New York, State Custodial Asylum. Albany, New York: State Board of Charities, 1915. Pp. 32.

There are charts showing the mental and physical ages of the fifty-two children, and a detailed account of each case, indicating the changes that have taken place since the first report was published.

RICHARD M. SMITH. *The Baby's First Two Years.* Boston: Houghton Mifflin Company, 1915. Pp. xi, 156. 75c.

The first ten chapters of the book give definite rules for the care and feeding of children up to two years of age. The second part consists of general suggestions which may be modified to suit the

individual baby. The third part presents recipes and charts. The chapters contain many helpful suggestions for the young mother, including complete directions for a typical day.

LOUIS STARR. *The Adolescent Period. Its Features and Management.* Philadelphia: P. Blakiston's Sons and Company, 1915. Pp. vii, 211. \$1.00.

This book is written in a popular style with the aim of being useful to parents and others who have in their hands the welfare of adolescent boys and girls. There are chapters on growth and muscular development, physical education, diseases of adolescents, criminal tendencies, and sexual enlightenment. In the final chapter the author proclaims himself an advocate of sex enlightenment and paints a vivid picture of the perversions to which the policy of silence frequently gives rise.

WILLIAM A. STECHER. *The Theory and Practice of Educational Gymnastics.* Philadelphia: John Joseph McVey, 1915. Pp. v, 188. \$1.50.

Part One of this book is devoted to general viewpoints regarding physical training in schools. The author distinguishes five age groups and indicates the kinds of games, plays, and gymnastics belonging to each. These age groups are first, infancy from birth to six years; second, childhood from six to twelve years; third, early adolescence from twelve to seventeen years; fourth, late adolescence from seventeen to twenty-one years; and fifth, maturity from twenty-one to full manhood. Part Two gives a detailed account of the essential physical training demanded by these age groups. Part Three gives a selection of useful exercises on apparatus and in games. Part Four describes dancing steps in the course of study. Part Five develops the principles underlying the selection and arrangement of movements. Part Six describes special exercises. Part Seven illustrates gymnastic positions. Parts Eight, Nine and Ten give typical complete lessons for each school grade. The book as a whole constitutes one of the most complete manuals of educational gymnastics that has yet been published.

LEWIS M. TERMAN. *Research in Mental Deviation among Children.* Research Laboratory of the Buckel Foundation, Bulletin Number 2, Stanford University, November 1915. Pp. 15.

The author here gives an account of the origin of the Buckel Foundation, and the lines of research which are now being carried on under its auspices. These involve studies of backward and feeble-minded children, delinquent children, nervous or morbid children, children of superior ability, and normal children. The author also calls attention to certain additions which are urgently needed to supplement the work of the present foundation.

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THE SELECTIVE SIGNIFICANCE OF REASONING ABILITY TESTS

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In February and March, 1906, tests in reasoning ability were given to 757 children from whom complete records were gotten in the fourth, fifth, and sixth school grades of Passaic, New Jersey. The full treatment of these tests and their immediate results are found in *The Reasoning Ability of Children of Fourth Fifth, and Sixth School Grades*, by the writer, Bureau of Publications, Teachers College. After nine years, a period which would practically insure that all of these children who would complete a high school course had accomplished that end, a study of what had become of them was made. The purpose was to discover whether the distribution and success of the individual pupils indicated any selective significance in the results of the reasoning ability tests.

Through the courtesy and co-operation of the Superintendent of Schools, Principal of the High School, and Principals of the schools in which the tests were made in Passaic, the full school record of those finishing eighth grade and those entering high school have been secured, excluding those only who removed from Passaic. A record of the fact of leaving school before finishing eighth grade for those who dropped out of the grades has also been gotten. The plan as comprehended at the outset included following up children after leaving school to note occupational successes or failures, and to consider these in relationship to the results of the tests. So far, this has not been accom-

plished. An attempt by correspondence failed most ingloriously. Of 225 brief blanks sent out with return postage paid but fifteen were returned. It is hoped to pursue this part of the study through personal visitation to a more satisfactory conclusion, the results of which will be made available when secured.

But the facts of distribution and correlation from the results now at hand are of interest and significance. The children discussed in this paper are distributed as shown in Table I. Since nothing but the mere fact of having left school, or "left school to go to work," is available for those 237 boys and 224 girls who did not finish eighth grade, 100 of each were taken by random selection for consideration and are designated as the "Left school" group. The 100 of each sex taken are nearly one half of the respective groups and are certainly representative of them. Pupils entering the high school but not graduating are designated throughout as "H.S. nongraduates." Those designated as "8th grade graduates" are those finishing eighth grade but not entering high school.

TABLE I.

Distribution of Children Studied

	Boys		Girls		Totals	
	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	385	50.86	372	49.14	757	100.00
H. S. graduates	51	13.24	49	13.17	100	13.21
H. S. nongraduates	49	12.72	51	13.70	100	13.21
8th grade Grades	48	12.46	48	12.90	96	12.68
Left school	100	25.97	100	26.88	200	26.42

On the basis of these groupings, the selections made by the school system itself, arrays were made of the results of the original tests for the total or combined resultant of all of the individual parts of the test, and those of the mathematical and opposites tests. The median ability of the respective groups, and, for comparison, the median ability of all of the pupils taken together, follow in Table II. The gradation of median ability of the respective groups from the "Left school" to the "H.S. graduates" is almost startling in its differences.

On the basis of the median ability for the entire group of boys and of girls, Table III shows the percentage in each of the respective groups above the median ability of all, and also above the median ability as measured upon the basis of the grade

TABLE II.

Median Ability of the Four Groups in Test Results

	Totals		Math. Tests		Opposites	
	Boys	Girls	Boys	Girls	Boys	Girls
For all	165.83	159.25	22.60	17.75	88.93	93.00
H. S. graduates	193.00	200.00	25.00	23.00	98.75	101.50
H. S. nongraduates	171.50	146.00	24.00	14.00	93.50	90.25
8th grade Graduates	166.50	156.50	22.00	16.00	90.00	89.00
Left school	149.00	153.00	20.00	17.50	79.50	88.00

TABLE III.

Percentage in Each Group Above the Median Ability of All

	Boys		Girls	
	Basis of all	Grade basis	Basis of all	Grade basis
H. S. graduates	72.52	70.56	79.58	77.55
H. S. nongraduates	55.09	57.13	35.29	45.09
8th grade graduates	54.15	52.06	49.99	47.91
Left school	31.00	41.00	42.00	42.00

TABLE IV.

Quartiles	On basis of all				On grade basis			
	Boys							
	Numbers							
	1	2	3	4	1	2	3	4
H. S. graduates	2	12	18	19	7	8	11	25
H. S. nongraduates	11	17	17	10	8	13	17	11
8th grade graduates	13	9	16	10	13	10	13	12
Left school	37	32	16	15	28	31	29	12
Percentages								
H. S. graduates	3.9	23.5	35.3	37.2	13.7	15.7	21.6	49.0
H. S. nongraduates	22.4	22.4	34.7	20.4	16.3	26.5	34.7	22.4
8th grade graduates	27.1	18.7	33.3	20.8	27.1	20.8	27.1	24.9
Left school	37.0	32.0	16.0	15.0	28.0	31.0	29.0	12.0
	Girls							
	Numbers							
H. S. graduates	5	5	11	28	6	5	13	25
H. S. nongraduates	17	16	5	13	14	14	13	10
8th grade graduates	12	12	16	8	14	11	16	7
Left school	27	31	26	16	33	25	25	17
Percentages								
H. S. graduates	10.2	10.2	22.4	57.1	12.2	10.2	26.5	51.1
H. S. nongraduates	33.3	31.4	9.8	25.5	27.5	27.5	25.5	19.6
8th grade graduates	25.0	25.0	33.3	16.6	29.2	22.9	33.3	14.6
Left school	27.0	31.0	26.0	16.0	33.0	25.0	25.0	17.0

distribution. In the original study, each respective grade was treated as a unit, all fourth grade boys together, all fifth grade boys together, and so on, as well as considering all boys and all girls as respective groups. Rating all boys together gives a median slightly higher than that of fourth grade boys and slightly lower than that of sixth grade boys. Table III shows percentages on the basis of median ability computed from both arrays.

A comparison of these percentages by either array points clearly the selective force at work in the school system on the basis of ability measured by the tests. For boys graduating from high school, but 13.7 per cent., by the grade array, come from the lowest quartile in ability while 49.0 per cent. come from the highest quartile. Of those leaving school before finishing the eighth grade, 28.0 per cent. come from the lowest quartile, and but 12.0 per cent. from the highest. From Table III, on the basis of all, it is seen that 72.5 per cent. of the high school graduate boys were above the median ability shown in the tests; of the high school boys who did not graduate, 55.1 per cent.; of the eighth grade graduates who did not enter high school, 54.2 per cent.; and of those leaving before finishing the eighth grade but 31.0 per cent. For girls the trend is about the same, but the percentage above median ability is notably greater for high school girl graduates. There is, however, to be noted here and in Table 1, a degree of ability for girls entering high school but not graduating less than that of girls finishing the eighth grade but not entering high school. The median ability by the tests of the group of high school girls not graduating is 146.0 while that of the eighth grade graduating group not entering high school is 156.5. The only explanation suggesting itself is, that entering high school for girls is not so much a matter of ability as for boys, but is more a matter of "going with the crowd." With nothing else to offer as entertaining or profitable occupation, the girl of relatively low ability may often enter high school, only to fall by the way when the work taxes her limited capacity beyond the point of pressure which she is willing or able to endure.

A very marked drop in ability is noted in passing from the groups finishing the elementary school to the group dropping out of the grades. By combining the results of all of those who finish eighth grade, including those entering high school, and comparing this total with that of those leaving school in the

grades, this difference is clearly brought out. Table V makes this comparison, first by quartile distribution, then by combining the quartiles below and above the median respectively, using the basis of array for all.

TABLE V.

Percentages by Quartiles and Halves of Combined Groups

Quartiles	Boys			
	1	2	3	4
All finishing eighth grade.....	17.6	21.6	34.5	26.3
Left school.....	37.0	32.0	16.0	15.0

Quartiles	Girls			
	1	2	3	4
All finishing eighth grade.....	22.9	22.3	21.6	33.1
Left school.....	27.0	31.0	26.0	16.0

Combining lower quartiles and upper quartiles respectively :

	Boys		Girls	
	Below M.	Above M.	Below M.	Above M.
All finishing eighth grade.....	39.2	60.8	45.3	54.7
Left school.....	69.0	31.0	58.0	42.0

Variability as measured by the coefficient of variability is found to be lowest in the group of high school graduates, and, in general, to increase in passing to groups of less total ability, as shown by the tests. Table VI shows the coefficients of variability for all of the boys and all of the girls respectively, and for each of the four groups in total ability, in the mathematics test, and in the opposites test.

TABLE VI.

Coefficients of Variability for All and for the Four Groups.

	Totals		Math. test		Oppos. test		Averages	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
For all	.22	.21	.26	.39	.18	.13	.22	.24
H. S. graduates	.13	.13	.26	.27	.12	.05	.17	.15
H. S. nongraduates	.21	.26	.21	.47	.15	.16	.19	.29
8th grade graduates	.24	.18	.32	.47	.19	.14	.25	.26
Left school	.24	.19	.34	.39	.22	.14	.27	.24

With respect to the particular interest in these results for the high school, the most significant feature is that of the evidence here shown that the high school tends toward the selection of students whose minds constitute a very definite type, and that this type is that which may be identified by the reasoning ability tests used with these groups three or four years before the begin-

ning of the high school period. The girls who enter high school but who do not graduate constitute a group of very high variability. Reference has been made to the relatively large number in this group who come from the lowest quartile of ability. This would, in part, account for the high variability of this group. For the variability in the totals of the tests, the variability of boys is equal to or greater than that of girls in all groups excepting that of the high school nongraduates. In the opposites test it is higher for all boys excepting in this group. In the mathematics test it is higher for girls in all groups. Reference to variability will be made again in connection with correlation of results in the tests and high school markings.

HIGH SCHOOL RATINGS

Complete ratings of courses passed for every student who attended high school are on record, and for all of these included among the children studied averages have been made. Failures are not recorded. Passing marks are by the use of letters, which, with the use of the plus sign, divide passing grades into seven groups, rated in value at from 3 to 9 inclusive. While differences in ability as shown by these marks are somewhat difficult to measure, even with this scale and the omission of all failures from the record, the summary of ratings of the two groups show differences in ability of significant magnitude. The averages in terms of the scale used in the marking system, together with coefficients of variability, are shown in Table VII.

TABLE VII.
High School Ratings and Variability

	Boys		Girls	
	Averages	Cot. of Var.	Averages	Cot. of Var.
H. S. graduates	4.71	.25	5.42	.20
H. S. nongraduates	4.00	.22	4.70	.30

AGE AND GRADE DISTRIBUTION AT THE TIME OF MAKING THE TESTS

To discover whether the age at which the tests were given had any bearing upon results, and likewise whether school grade indicated any significant difference, arrays of all pupils entering high school were made on the basis of the age and grade of the pupils when the tests were given. The median ability in the tests and the high school averages of these age and grade groups are shown in Table VIII.

TABLE VIII.

Age and Grade Distribution When Tests Were Given

	Age Distribution			
	Boys		Girls	
	Under 11	11 or over	Under 11	11 or over
Number	55	45	54	46
Median of totals	179.00	182.00	155.50	195.50
H. S. averages	4.33	4.52	4.66	4.07

	Grade Distribution			
	Below G. VI	Grade VI	Below G. VI	Grade VI
Number	58	42	66	34
Median of totals	171.50	197.50	151.00	208.00
H. S. averages	3.75	4.07	4.41	4.36

By the age distribution it is seen that those who were older when the tests were given show a higher median ability, and that the older boys show a slightly higher high school average. The average of the older group of girls, however, is lower than that of the younger group. Results from the grade distribution are almost parallel. The selective element in the school system, and the fact that in the sixth grade the effects of school training has made the tests a little less valid as native ability tests than in lower grades, would lead one to expect just such results as these arrays have demonstrated. That the high school record of these older girls did not fulfill the promise of their high median ability in the tests may be explained on the basis of the fact that school training had somewhat invalidated the tests, and that, for girls, this age is a period of maximal mental growth and acuity in the somewhat rhythmic periodicity in development. While the girls made markedly better median ratings than the boys at this age they were as markedly lower in the earlier period. Further reference to the significance of age and grade distributions will be made in discussing correlations.

INDIVIDUAL CORRELATIONS

Naturally the first interest in correlation is whether ability as shown in the tests is correlative with ability as shown by high school ratings. Table IX gives the coefficients of correlation, by the method of unlike signs, of the three arrays of high school students, the groupings into graduates and nongraduates, the age distribution, and the grade distribution, using the totals of the tests with the high school ratings.

TABLE IX.

Correlation of Test Totals and High School Averages

	Boys		Girls	
	r	P.E.	r	P.E.
H. S. graduates	— .179	.09	+ .130	.09
H. S. nongraduates	— .394	.08	— .179	.09
Under 11 years	+ .307	.08	+ .537	.07
11 years or over	— .114	.10	+ .076	.11
Below Grade VI	+ .134	.09	+ .550	.06
Grade VI	+ .089	.11	+ .260	.11

Further correlations have been derived, using the high school ratings and the mathematics and opposites tests, two of the most significant tests in the full series used. The results follow in Table X.

TABLE X.

Correlations of High School Averages with Mathematics and Opposites Tests

	H. S. Av. and Math.				H. S. Av. and Opposites			
	Boys		Girls		Boys		Girls	
	r	P.E.	r	P.E.	r	P.E.	r	P.E.
H. S. graduates	+ .318	.08	+ .037	.09	— .388	.08	+ .110	.09
H. S. nongraduates	— .037	.09	+ .107	.09	— .110	.09	+ .178	.09

While grouping the students as graduates and nongraduates gives a negative correlation of high school averages and totals, except for the graduate girls, the groupings by age and grade give positive correlations for all except boys over eleven years of age. However, because of the low degree of correlation and the relatively high probable error, these are insignificant excepting for the lower age and grade groupings. In the groups under eleven years, and also below the sixth grade, the correlations are much higher than for the older and upper grade groups, and are large enough to be really significant. These facts of correlation suggest that the species of general ability measured by the tests given is probably more appropriately to be found in children under eleven years than later, a majority of which children will be found below the sixth grade. As was noted in the original study, and in a preceding paragraph, the validity of these tests seems to diminish somewhat as we apply them above the fifth grade.

Reference to Table VIII shows that the high school average of girls tested before the age of eleven is higher than for those of eleven, and of girls below the sixth grade higher than of those

in sixth grade. In addition to the factors already noted which might, in part, account for this condition, there is the possibility that the high school has recently exercised a more exacting selection on the basis of ability than earlier. The growing opportunities for both boys and girls to secure work within the more recent years may have attracted many pupils away from school who would have continued under earlier conditions. That the correlation of test results and high school averages is higher for both boys and girls tested below the sixth grade suggests that the tests may well be given early, in fourth or fifth grade, if they are to be of most value in educational guidance.

While the correlations as a whole are perhaps less conclusive than one may have anticipated, it is not without a feeling of confidence in the validity of the tests that we note that the correlation between test results and high school averages for pupils tested under eleven years of age is $+ .307$, P.E. $.08$, for boys, and $+ .537$, P.E. $.07$, for girls. The median abilities of the respective groups shown in Table II, and of the quartiles in ability from which the several groups come shown in Tables III and IV, indicate that the type of ability measured by the tests is a very significant index of the selective function which is exercised by the school system as now organized in holding and eliminating pupils.

That we might know what effect the grouping determined by the selective function of the school system would have upon correlations between different elements in the series of tests themselves, correlations were made for these new groupings between test totals and the mathematics test, totals and opposites, and mathematics and opposites. For comparison, the average correlations found in the original study by combining the correlations of both age and grade distributions for the whole number of boys and of girls, respectively, are indicated at the right of these correlations. Results are shown in Table XI.

Of the twenty-four correlations, seventeen are higher than the average correlations for all pupils in the tests in the original arrays. The selection producing this distribution is clearly more definitely based upon differences in a type of ability than age or elementary school grading will show. This grouping removes the array much further from a natural distribution.

TABLE XI.
Correlation of Test Results for the Four Groups

	H. S. grad's	H. S. nongrad's	Boys 8th grade grad's	Left school	Ay. for all orig. study
Totals and mathematics	+.50	+.67	+.83	+.66	+.53
Totals and opposites	+.95	+.84	+.92	+.90	+.87
Math. and opposites	+.55	+.57	+.75	+.19	+.41
			Girls		
Totals and mathematics	+.57	+.74	+.92	+.71	+.64
Totals and opposites	+.80	+.85	+.92	+.73	+.83
Math. and opposites	+.67	+.70	+.71	+.45	+.47
		Averages			
Boys	+.67	+.69	+.83	+.58	+.60
Girls	+.68	+.76	+.85	+.63	+.65

The groups of high school graduates and those leaving school before finishing the eighth grade show a general tendency toward lower correlation than either the high school nongraduates or the eighth grade graduates. For the high school graduates and the left school groups respectively, the correlations are $+.68$ and $+.61$, while those of the high school nongraduates and the eighth grade graduates are $+.73$ and $+.84$ respectively. The average for the groups extreme in ability is $+.64$ and for the median groups, $+.78$. There is apparent, therefore, a tendency toward specialization of ability in those whose total general ability is most remote from median ability, both above and below.

Rather definite sex differences are apparent in these correlations. Of the twelve pairs of correlations, eight are higher for girls, one is the same for both boys and girls, and three are higher for boys. The correlations of high school averages and test results, Table IX, shows that, in nine of the ten cases, the correlation is higher for girls than for boys. The coefficient of variability in high school averages is .25 for boys, .20 for girls. In general, the results show that variability, as measured by the quartile coefficient, is low where correlation is low, and high where correlation is high. Reference to Table VI in comparison with Table XI will show this. The average variability for the extreme groups, Table VI, is .21, average correlation for the corresponding groups, Table XI, is $+.64$; for the median groups, variability .25, correlation $+.78$. From Table VI, it is found that the ratio of variability of boys to girls is 1.133 for the high

school graduates, and 1.125 for the group leaving school before finishing eighth grade; while for the group of high school non-graduates the ratio is .633, and for the eighth grade graduates .961. The average ratio of boys to girls for the extreme groups is 1.129, for the median groups, .797.

The results of correlation and variability taken together indicate that the tests are measures of a species of general ability that is less broken up by specialized aspects or varieties varying in intensity in girls than in boys if the total ability is remote from the median, either above or below; that the reverse is true for groups of more nearly median ability; and that in both boys and girls the tendency is greater toward the breaking up of general ability into varieties or aspects differing in quantitative significance in the groups of extreme ability, either high or low, than in those of median ability on the basis of a natural or total distribution. In so far as this is true, the general conclusion that boys are more variable in mental ability than girls in a natural distribution loses any value it may have in application to individuals or selected groups unless their place in a scale of general ability is known. While the data here used are by no means adequate to establish broad generalizations, the question arises whether the conclusion that boys are more variable than girls may not be derived from a failure to give adequate weight to cases of extremes, a conclusion true enough for selected groups at both ends of the scale, but invalid for the groups clustering about the median in a natural distribution.

THE TESTS AS A BASIS OF PROBABILITY OF SCHOOL ATTENDANCE

For the individual child, it is of much significance to know what chance or probability he has for reaching various grades or levels in the general school system. On the basis of the tests and the subsequent progress of the 754 children, results show that a prediction may be made for any pupil that is much more than a random guess. If the pupil falls within any respective quartile of ability as shown by the tests, in fourth, fifth, or sixth grade, what are the chances that he will finish the eighth grade? That he will enter high school? That he will finish the high school course? Table XII shows the chances in 100, based upon the performance of the 754 children, of reaching these several grades of school attainment when found in each of the respective quartiles of ability.

TABLE XII.

Probability Expressed as Chances in One Hundred

When found in one of the four quartiles of ability, the chances in 100 are, respectively:

Of finishing eighth grade:				
Quartiles	1	2	3	4
Boys	29.1	32.3	42.7	49.9
Girls	36.6	32.3	45.1	45.1
Of entering high school:				
Boys	15.6	21.9	29.1	37.5
Girls	21.5	20.4	27.9	37.6
Of finishing high school:				
Boys	7.3	8.3	11.5	26.0
Girls	6.5	5.4	13.9	26.9
Of finishing eighth grade but not entering high school:				
Boys	13.5	10.4	13.5	12.5
Girls	15.0	11.8	17.2	7.5
Of entering high school by those finishing eighth grade:				
Boys	53.6	67.7	68.3	75.0
Girls	58.8	63.3	61.9	83.3
Of finishing high school by those who enter:				
Boys	46.6	38.1	39.3	69.4
Girls	30.0	26.3	50.0	71.4

Without reference to ability, the chances in 100 for reaching the various grades of attainment are:

	Finish G. VIII	Enter H. S.	Finish H. S.	Finish G. VIII but not enter H. S.	Enter H. S. but not finish
Boys	38.4	25.9	13.2	12.5	12.7
Girls	39.8	26.9	13.2	12.9	13.7

Expressed as multiples, it is seen that pupils in the highest quartile of ability have chances greater than those in the lowest quartile as follows:

- Of finishing the eighth grade:
Boys, 1.7 times greater; girls, 1.2 times greater.
- Of entering high school:
Boys, 2.4 times greater; girls, 1.7 times greater.
- Of finishing high school:
Boys, 3.5 times greater; girls, 4.1 times greater.

For boys, considering all quartiles of ability, the greater the ability the greater the chance of reaching the respective grades of attainment. For girls, this is true with the exception of those in the second quartile of ability. Girls just below median

ability have chances slightly lower than those in the lowest quartile of ability. After entering high school, there is also an exception for boys to the general statement. Those entering high school who come from the lowest quartile have a greater chance to finish than those coming from the second and third quartiles. For girls, the better chance of those in the lowest quartile may lie in the possible opportunity for work greater for the girl of median ability than the one just below median ability. Not securing work so readily, some girls of low ability may continue in school as an occupation with social satisfactions in preference to idleness, even at the cost of much mental effort.

Just what it may be worth to know that the tests enable us to say that a given boy in one of these middle grades has 3.5 times as great a chance of finishing high school as another given boy, or that one has 26 chances in 100, the other but 7.3 in 100, may not be wholly clear. Yet thus placing the boys in this relative position, and knowing the part this element plays in the complex selective process of the school, we might reasonably count it a distinctly tangible factor with which to work in educational guidance. We may at least say that we have taken a long step from the situation which made any prediction a mere guess toward a prediction based upon data that is scientific so far as it goes. To say that a boy has general ability which makes it seem probable that he will go to high school and finish the course is altogether less scientific and satisfactory than to say that the chances are 26 in 100 that he will do so. Of two boys, to say that the chances of one to enter and finish high school are 3.5 times greater than those of the other is far more illuminating and scientific than to say that one will probably finish high school and the other will probably not.

CONCLUSION

This study of the relationship between test results in the grades and subsequent school performance, incomplete as it is, seems sufficiently positive in its bearings to lend much encouragement to the hope for easily and quickly applied tests whose results are significant for educational guidance. If, by one hour's time devoted to testing a group of fourth grade children, however large the group, and the additional few hours required to grade and array the results, we shall be able to identify those of the

type of ability attracted by and successful in the academic high school, we shall have established a basis for a really scientific treatment of the problem of partial differentiation in school work. We shall be able not only to offer greater opportunities for the best development of the group ranking highest in the tests, but likewise so to modify school offerings as to give other children appropriate opportunities not now fully provided in upper grades and high school.

The tests in full with directions for giving, grading, and arraying results are found in the study referred to in the opening paragraph of this paper. Superintendents and teachers are privileged to have copies of the test papers made in quantity for class room use. The data from the 754 cases are in such forms that they may be readily combined with results from any number of additional children. The addition of several thousand cases would aid materially in further establishing the validity of the tests or in revealing their limitations.

ORAL AND SILENT READING

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In the psychology of reading the striking differences between reading orally and reading silently have often been noted, but comparatively little beyond measuring the difference in speed seems to have been done. Theoretically the difference between the two processes is in itself interesting and it becomes more so when we consider the indirect bearing that it may have upon our educational procedure in the instruction of reading. Romanes, Quantz, Huey, and Abell,¹ have given us results on the rapidity of reading both silent and oral. Pintner² has discussed the factors of inner speech that seem to play an important part in silent reading, emphasizing the fact that habits acquired in oral reading were carried over to silent reading and may lessen the efficiency of silent reading. Work with school children in the grades has been done by Pintner and Mead.³

With fourth grade children Pintner found that silent reading was the most economical. The children read faster and retained per unit of time more of the material read. Mead with sixth grade children comes to practically the same conclusion showing that "each class reproduced a greater percentage of possible points by the silent method of reading than by the oral method."

In the present study we have attempted to extend the scope of this work in order to obtain a comparison of oral and silent reading at different grades in the elementary and high schools and also in college. The rate of reading and the amount reproduced were taken into consideration. We have therefore a

¹ ROMANES. *Mental Evolution in Animals*.

QUANTZ, J. O. *Problems in the Psychology of Reading*. Psych. Rev. Mon. Supp. Vol II. 1897.

HUEY. *The Psychology and Pedagogy of Reading*. 1900.

ABELL, A. *Rapid Reading*. Educat. Rev. vol. 8. 1894.

² PINTNER, R. *Inner Speech During Silent Reading*. Psych. Rev. vol. 20. No. 2, March, 1913. p. 130.

³ PINTNER, R. *Oral and Silent Reading of Fourth Grade Pupils*. Jour. of Ed. Psych. vol. IV. No. 6. June, 1913. pp. 333-337.

MEAD, C. W. *Silent vs. Oral Reading with One Hundred Sixth Grade Children*. Jour. of Ed. Psych. vol. VI. June, 1915. Cf. also JUDD, C. H. *Measuring the Work of the Public Schools*. Cleveland Education Survey. 1916.

comparison between oral and silent reading at different stages of development and an attempt has been made to determine which is the most economical (1) for time, (2) for reproduction, and (3) for general results.

THE METHOD OF PROCEDURE

Sets of twelve cards were prepared upon each of which a paragraph was typewritten. Each paragraph contained about fifty words and seven distinct ideas. The cards were prepared in pairs of about the same difficulty and on subjects of different interests. Each card of a pair was on a topic similar to the other card but not enough like it to be confusing.

One set of cards was used for the third and fourth grades, another for the fifth and sixth, another for the seventh and eighth grades, another for the high school, and another set of sixteen cards was used with the college students. These different sets were suited to the ability of the grades using them. The first set of paragraphs was selected from magazine articles with the idea of equal difficulty, number of words, and number of definite ideas. The other sets were made partly from new material and partly from a changed wording of the original paragraphs suiting them to the ability of the readers. The seven distinct ideas were determined when the passage was selected and marked by placing a period under the essential word or group of words representing each distinct ideas. These marks, of course, did not appear on the card shown to the reader. In the sample below, the words are set off by vertical lines. This method of marking was used because neither the number of words nor the same grammatical forms were to be reproduced but only the same ideas. The following is a sample of the paragraphs used. It is one of the set used in the third and fourth grades.

The Amazon | is the longest river in the world. It drains most of the northern half | of South America. Its mouth is along the equator. | The rubber tree grows in this river valley | and the few people who live there spend most of their time making gum.

The following number of persons were tested: 30 of the 3-4 grades, 30 of the 5-6 grades, 20 of the 7-8 grades, 20 high school pupils, and 30 college students, making in all 1680 selections read or 840 read aloud containing 5880 points and the same number read silently.

Realizing that the method of determining the points in the paragraph was entirely arbitrary, the first half of each group, *i. e.*, the first 15 of the 3-4 grades, for example, read the odd numbered selections aloud and the others silently, while the second half of the group read the odd selections silently and the even selections aloud. This method tended to equalize the varying degree of difficulty that would naturally remain in spite of the most careful selection of material. The same person gave all the tests, taking the time required to read each selection, and graded all the papers, thereby securing uniformity of method. The papers were graded according to the number of ideas reproduced. Anything that seemed to indicate that the reader had grasped and remembered the passage was counted correct. No attention was paid to bad composition or grammar.

Starch⁴ has proposed to determine the comprehension by counting the number of words written which correctly reproduce the thought. It seemed to us that no advantage was gained by first going over the passage and determining which words correctly reproduced the thought and then counting the number of words. Whether the words reproduce the thought or not has to be subjectively determined by either method. Again the same thought may be expressed correctly in few or many words, and it does not by any means follow that the many-worded expression is the better. There seems therefore to be no advantage in this more complicated method.

The following instructions were given to the reader: "I have here a paragraph that I want you to read *once only*. After you have read it over once aloud (or silently) you are then to write down all the ideas you can remember that you have read, not necessarily in the exact words used in the paragraph but just so you get all the ideas."

After grading each selection by counting the number of ideas reproduced in each case, this number was divided by the time in seconds required to read the paragraph, giving the per cent. of an idea gained per second, for example, if five ideas were reproduced from a paragraph and it took fifteen seconds to read the selection it would be expressed as 33.3%. This method was adopted in order to combine both the time and the ideas into one value and we have called this value the "Reading value."

⁴ STARCH, DANIEL. *The Measurement of Efficiency in Reading, Writing, Spelling, and English*. Madison, Wis. 1914.

RESULTS

The individual records for each observer cannot be printed here because of the large number tested. Our tables show the averages of the twelve passages read for each observer.

Time. Table I shows the average time for each observer for reading the twelve passages. The upper half of the table gives the times for reading aloud and the lower half for reading silently. Under each heading (college, h. s., 7-8 grades, etc.) there are two columns. The first gives the averages for the individuals who began with selection I aloud and then alternated, aloud and silent, for the rest of the selections. The second column gives the averages for those who began with selection I silently and then alternated, *i. e.*, read silently those passages which the first group had read aloud. This same classification appears in Tables II and III.

It will be seen that the average time for the different grades varies slightly inasmuch as the lower grades on the whole take longer than the higher ones. This merely indicates that the passages for the lower grades may have been relatively a little harder than those for the higher grades. But this difference is not vital to our problem. Our real interest lies in a comparison of the general averages for reading aloud and silently. The college students read faster silently, taking on the average 13.0 seconds for the silent passages and 15.4 sec. for the aloud passages. The same is also true of the high school pupils, here the difference being 17.4 silent and 18.0 aloud. The other three groups show no advantage as regards time for silent reading. In two groups (grades 5-6 and 3-4) the general average is about the same and in the third group, grades 7-8, the average time for reading aloud is less than for reading silently. This would seem to suggest that increase in rapidity of reading comes relatively late and that with children silent reading differs from oral reading merely in the fact that the words are not pronounced aloud and there may be in this silent reading almost as much articulation as in oral reading. Only later in life with more practice in reading are the motor concomitants of silent reading shortened leading to an increase in the speed of reading. Looking at the actual number of individuals who read quicker silently we find that all the college students, with the exception of two, fall within this group and the difference between the time for

TABLE I.

Average Time Required for each Individual to Read the Twelve Paragraphs

No. of Observer	READING TIME ALOUD									
	College		High School		Grades 7 and 8		Grades 5 and 6		Grades 3 and 4	
	1	2	1	2	1	2	1	2	1	2
1	11.5	14.3	17.0	21.0	8.7	15.7	22.7	14.8	14.5	21.0
2	13.6	17.0	18.0	17.0	15.7	15.3	17.0	18.5	17.5	19.5
3	12.5	16.4	16.0	19.5	15.2	26.4	17.3	20.7	17.4	22.8
4	15.6	14.0	17.0	19.5	14.7	23.3	17.7	14.9	25.7	16.3
5	15.5	18.0	17.0	17.0	18.4	15.4	16.0	14.0	16.3	18.2
6	15.5	14.7	15.5	13.5	12.3	16.6	17.0	21.5	18.2	28.5
7	16.0	16.5	16.0	18.0	24.0	17.2	16.0	22.3	14.8	27.0
8	15.0	16.5	17.5	21.0	16.3	13.1	16.0	18.7	15.3	19.5
9	14.0	16.7	21.5	21.7	9.2	15.0	17.5	23.0	15.3	19.7
10	13.0	14.0	19.7	17.3	11.0	16.7	18.0	13.0	21.2	23.5
11	13.0	13.2					16.0	16.0	13.7	27.3
12	17.4	15.4					23.0	33.3	14.8	17.0
13	19.6	15.0					12.7	21.0	16.0	28.0
14	15.7	18.6					14.0	19.0	24.7	27.0
15	14.7	20.3					16.4	22.5	28.0	18.3
Average	14.8	16.0	17.5	18.5	14.5	17.5	17.1	19.5	18.2	22.2
Gen. Avge.	15.4		18.0		16.0		18.4		20.2	
	READING TIME SILENTLY									
	1	2	1	2	1	2	1	2	1	2
1	11.3	9.7	20.1	19.5	11.7	14.7	22.5	14.3	13.0	21.5
2	13.0	13.5	20.0	23.0	15.8	23.3	12.0	19.1	13.5	26.3
3	13.0	14.1	13.2	15.0	15.3	25.3	17.5	17.5	15.3	24.0
4	13.0	10.3	16.3	14.0	15.5	27.0	17.5	18.5	27.0	15.2
5	13.0	13.0	19.3	16.7	20.5	15.5	18.7	17.2	16.3	13.1
6	16.7	8.3	15.7	12.5	15.3	17.5	15.5	20.7	10.7	26.0
7	14.0	13.0	13.3	14.9	24.3	26.0	15.3	20.0	15.5	23.2
8	14.7	12.0	14.5	18.2	19.7	16.5	15.0	20.1	13.5	19.5
9	10.5	13.4	24.0	20.0	14.2	14.0	22.5	22.0	13.0	21.0
10	10.9	10.0	18.0	21.1	15.5	14.0	19.0	17.3	18.5	28.0
11	11.0	10.0					22.3	17.7	13.3	31.0
12	18.0	11.6					23.7	29.5	15.1	16.0
13	21.4	12.7					10.7	17.7	18.3	36.0
14	14.0	12.0					11.6	18.5	24.7	24.5
15	13.6	19.0					18.3	21.3	27.1	27.0
Average	13.9	12.2	17.4	17.4	16.8	19.4	17.5	19.4	17.0	23.5
Gen. Avge.	13.0		17.4		18.1		18.5		20.2	

oral and silent reading of these two individuals is negligible, being 0.2 and 0.6 sec. respectively. Of the high school pupils 60 per cent. do better silently. In the lower grades the percentages are 14, 56, and 50, showing in the last two groups about an equal number who do better by each method.

POINTS REPRODUCED

Table II shows the average number of points reproduced for each individual and the general average for each group.

Comparing the general average for each group we see a decided uniformity in the amount reproduced by both methods. In every group about the same amount is reproduced whether the passage is read aloud or silently. The added reinforcement of the memory that, it might be argued *a priori*, ought to be shown because of the added auditory stimulus when reading aloud, is not apparent. Similarly we find no basis for any belief in the idea that the auditory stimulus leads to a distraction of the attention and thus results in less being remembered. It does not seem to matter as far as reproduction is concerned whether a passage is read aloud or silently.

THE READING VALUE

The combination of the two factors of speed and reproduction is given in the reading value, expressing the per cent. of a point reproduced per second of the reading time. Table III gives the average for each individual and the general average for the groups.

For the college group the reading value for silent reading is much higher than for oral. For silent it is 38.4 as compared with 33.5 for oral, making a difference of 4.9 in favor of silent reading. For the high school group we have 25.2 for silent and 23.6 for oral or a difference of 1.6 in favor of silent. For the next two groups, grades 7-8 and grades 5-6, the average for the silent method is very slight being 0.6 and 0.8 respectively, and lastly for grades 3-4 the values for both methods are exactly the same. These figures would seem to indicate an increasing advantage for silent reading as the individual grows older.

The results may also be looked at from another angle. If we count the number of individuals in each group who do better by each method we have the following results. Omitting those who did equally well by both methods we find that six out of

TABLE II.
Average Number of Points Reproduced

No. of Observer	College		READING ALOUD							
			High School		Grades 7 and 8		Grades 5 and 6		Grades 3 and 4	
	1.	2	1	2	1	2	1	2	1	2
1	6.0	4.4	4.5	4.6	4.9	6.3	3.9	4.8	5.2	5.4
2	5.5	4.0	3.7	4.5	3.9	5.0	5.0	4.0	6.1	5.3
3	5.7	4.1	4.5	5.2	6.6	5.2	4.2	3.5	4.7	4.9
4	6.6	6.1	3.7	3.6	5.3	6.0	2.7	6.0	5.0	3.7
5	5.6	3.7	5.3	2.7	6.4	5.2	4.9	5.7	6.5	6.0
6	5.1	4.8	4.0	4.9	3.5	5.3	2.6	4.5	5.5	4.5
7	6.0	5.4	3.9	5.2	5.9	6.0	5.7	6.3	4.7	4.5
8	5.5	4.6	2.0	4.7	6.3	4.9	4.7	4.2	4.0	3.7
9	5.8	4.3	4.0	4.9	4.7	6.0	3.2	5.0	4.6	3.3
10	5.1	5.5	3.7	5.0	6.2	5.5	3.2	4.9	5.0	5.0
11	4.1	6.3					5.3	3.2	3.3	3.0
12	4.5	3.6					4.3	4.3	3.2	4.0
13	5.1	4.0					6.2	3.7	4.2	5.0
14	5.4	5.0					5.5	4.0	3.5	4.0
15	4.7	5.3					5.9	5.4	2.5	4.3
Average	5.38	4.74	3.93	4.53	5.37	5.54	4.49	4.63	4.53	4.44
Gen. Avge.	5.06		4.23		5.46		4.56		4.49	

READING SILENTLY										
1	6.0	4.0	3.9	5.0	6.1	6.3	2.5	4.8	5.4	4.3
2	5.4	4.0	4.0	5.3	4.0	6.2	4.8	4.2	5.7	4.0
3	6.0	3.7	4.0	4.7	6.5	6.6	6.0	4.0	4.7	4.3
4	5.0	5.5	3.4	4.5	4.9	5.0	2.3	6.8	5.0	3.3
5	3.7	3.7	4.2	2.7	6.6	5.2	4.5	5.7	5.9	4.7
6	4.3	4.9	3.9	4.7	4.5	4.7	3.5	4.7	5.0	3.6
7	5.7	5.3	4.7	4.3	6.0	5.7	5.5	5.3	4.5	3.0
8	5.8	4.5	2.5	4.6	6.5	4.9	4.7	5.7	5.4	2.7
9	5.3	4.0	4.5	5.0	5.7	5.3	4.4	5.0	4.7	4.0
10	4.6	5.7	4.2	6.0	5.8	5.4	4.0	5.0	4.0	4.3
11	4.4	5.5					5.0	4.3	3.6	2.5
12	4.0	4.5					5.3	4.0	4.3	3.0
13	4.7	4.0					5.8	3.5	4.7	6.0
14	4.8	3.7					6.2	3.7	3.4	3.3
15	5.7	5.7					6.0	4.7	1.6	2.7
Average	5.02	4.58	3.93	4.68	5.66	5.47	4.70	4.76	4.52	3.71
Gen. Avge.	4.80		4.31		5.57		4.73		4.12	

TABLE III.
The Reading Value

No. of Observer	College		High School		Grades 7 and 8		Grades 5 and 6		Grades 3 and 4	
	1	2	1	2	1	2	1	2	1	2
1	51.0	31.0	26.3	21.7	53.0	40.2	17.0	33.1	35.6	25.8
2	40.0	23.0	20.0	26.0	24.7	33.3	29.3	21.7	34.9	27.3
3	46.0	25.0	28.0	27.0	42.4	19.0	24.6	23.3	27.3	21.3
4	42.0	43.0	21.4	18.4	31.7	25.7	15.5	37.0	19.5	22.4
5	36.0	21.0	31.2	15.8	32.1	34.2	31.0	33.2	39.8	30.7
6	33.0	32.0	24.7	36.4	29.3	31.5	15.5	23.0	30.3	15.8
7	41.0	33.0	23.7	29.0	24.4	31.4	36.3	26.5	31.4	11.5
8	31.0	28.0	10.4	23.2	33.0	36.7	30.0	28.0	25.5	19.2
9	41.0	25.0	19.0	22.7	40.6	39.0	18.0	23.2	29.5	17.0
10	40.0	40.0	18.6	29.4	37.1	33.5	17.6	27.9	23.1	21.8
11	33.0	47.0					33.3	24.5	24.4	11.0
12	26.0	24.0					18.5	13.0	21.9	24.0
13	26.0	25.5					48.7	19.0	26.6	17.6
14	34.0	29.0					39.0	20.2	14.2	14.6
15	32.0	26.0					35.5	22.0	9.0	23.1
Average	36.8	30.2	22.3	25.0	34.8	32.5	27.3	25.4	26.2	20.2
Gen. Avge.	33.5		23.6		33.6		26.2		23.2	
	1	2	1	2	1	2	1	2	1	2
1	52.2	40.0	19.0	26.0	55.7	43.2	11.0	32.4	41.7	20.0
2	41.0	30.0	19.6	23.3	24.5	26.4	40.0	20.7	42.6	15.5
3	45.0	27.0	30.4	31.7	43.4	23.0	33.4	17.0	30.4	18.2
4	40.0	54.0	21.0	32.0	36.2	19.1	13.3	40.1	18.4	22.0
5	29.0	29.0	21.7	16.0	35.3	33.3	24.0	40.4	35.7	36.1
6	26.0	59.0	24.5	37.3	28.2	27.1	18.0	20.7	46.9	15.1
7	41.0	40.0	35.0	29.0	24.3	21.8	36.0	28.0	28.8	12.1
8	40.0	37.0	17.2	25.0	38.6	29.0	31.6	22.7	39.9	14.0
9	50.0	30.0	18.7	25.0	50.5	38.5	18.5	22.0	37.0	18.0
10	43.0	57.0	23.1	28.3	47.7	38.7	20.6	37.6	21.8	15.3
11	40.0	54.0					21.8	20.0	25.4	8.1
12	21.0	38.0					22.5	13.0	28.6	18.1
13	22.0	30.0					54.0	17.7	25.8	16.1
14	34.0	31.0					52.0	21.4	13.8	13.6
15	41.5	30.0					35.0	23.7	6.0	10.1
Average	37.7	39.1	23.0	27.3	38.4	30.0	28.8	25.2	29.5	16.8
Gen. Avge.	38.4		25.2		34.2		27.0		23.2	

thirty college students did better reading aloud while twenty-two did better reading silently. Eight high school pupils did better reading aloud and eleven reading silently. Ten of the 7-8 grade pupils did better reading aloud and ten reading silently. Fourteen of the 5-6 grade pupils did better reading aloud and fifteen reading silently. Nineteen of the 3-4 grade pupils did better reading aloud and eleven reading silently. These values expressed in per cent. of the total number in each group are as follows:

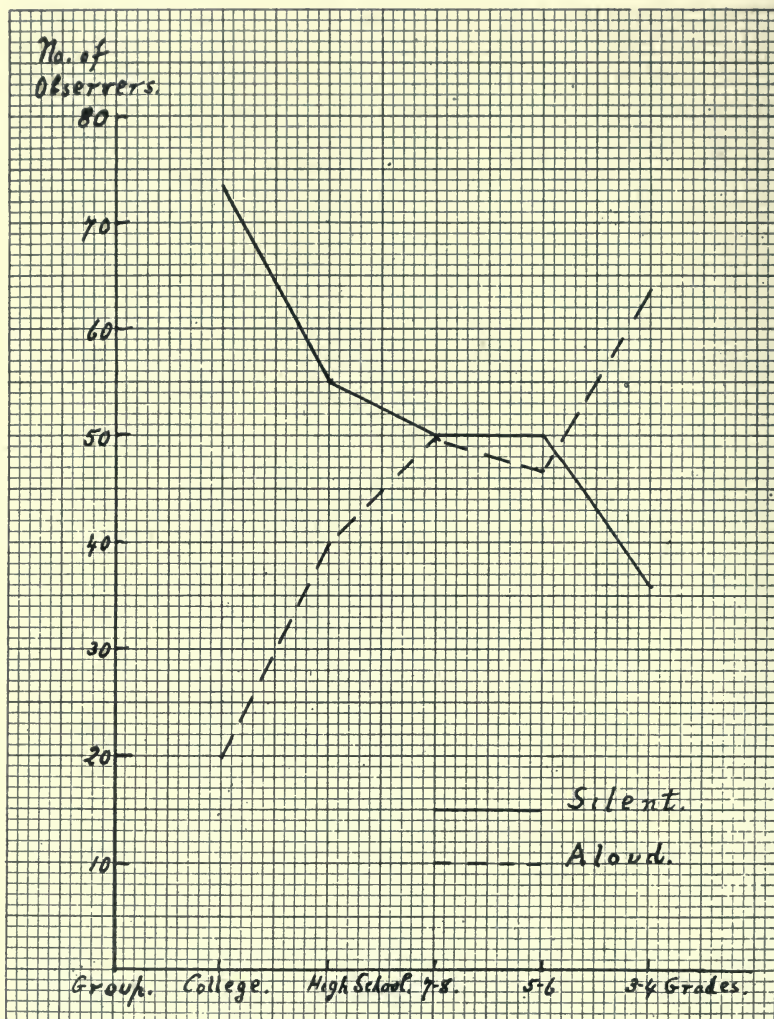
	College	H. S.	7-8	5-6	3-4
Aloud.....	20.0	40.0	50.0	46.6	63.3
Silent.....	73.3	55.0	50.0	50.0	36.6

This is shown graphically on the following curve.

LONG PASSAGES

In addition to the above results experiments were made with fifty university students reading longer passages. Two passages each containing 43 ideas and about 200 words each were used. In all other respects the conditions of the experiment were the same as before. Half of the observers read one passage aloud and the other silently, the other half read in the opposite method.

The average time for the fifty observers for reading silently was 52.6 seconds and for reading aloud was 65.4, being a saving of 12.8 sec. for silent reading. Reading silently, an average of 14.5 points was reproduced as compared with 13.8 points reading aloud. Here again as with the shorter passages we see no marked difference between the number of points reproduced by either method. Combining the time and the amount reproduced into the reading value for each individual and taking the average of these reading values for all the fifty observers, we find the average reading value for silent reading to be 29.07 as opposed to 21.91 for reading aloud, being a gain of 7.16 in favor of silent reading. Counting the number of individuals who had a higher reading value for silent reading we find thirty-six out of the fifty or 72 per cent. better at silent reading. It was also noted as before that the few who did better in reading aloud showed only a slight advantage over the silent reading. This can be expressed numerically by the difference between the reading values of each individual. The total difference in favor of silent reading for the thirty-six



Graph showing the percentage of observers in each group who did better in reading silently or in reading aloud.

observers is 427.1 or an average of 11.9 whereas for the thirteen who did better aloud (one did exactly the same by both methods) we have a total difference in favor of oral reading of 69.3 or an average of 5.3. This again shows that those who did better in reading aloud surpassed their silent reading much less than those who did better silently surpassed their reading aloud.

CONCLUSIONS

It does not seem to make much difference whether a child in the third grade reads aloud or silently. He gets about the same number of ideas per second either way. As we progress through the grades and up into college we find that it takes comparatively longer and longer for reading aloud and this increased time may result in an increase in the number of ideas reproduced. But this number of ideas gained is not nearly commensurate with the extra time expended. The silent reading of the adult is quicker than the oral reading and at the same time the number of ideas remembered is slightly greater, certainly much greater per unit of time. Thus it would appear that silent reading is undoubtedly the more economical besides being the method best adapted to the ordinary activities of life, since the vast majority of our reading is silent. This being the case we are forced to raise the pedagogical question and ask, why it is that so much more attention is given to oral reading than to silent reading in our schools.

We do not propose that the child should first be taught to read silently. It is probably necessary to teach him to read orally first. In learning any new activity the child cannot at first execute it without a great many superfluous movements. Everything tends to express itself in movement in his mental life. But as the learning process goes on he tends to eliminate superfluous movements in his motor responses and also in his responses more intimately connected with his mental life. All this is only the ordinary history of the development of all our exact physical and mental acts, a gradual elimination of all unnecessary processes.

The child in his early learning processes invariably expresses his ideas and meanings in words and movements. But soon the child is able to think without expressing his thoughts verbally. Many of the muscular concomitants of the thoughts are sup-

pressed. This same thing is probably true in the reading processes, one of the great ways by which the child gets new thoughts and ideas. When the child is first learning to read he should give motor expression to his reading. But, as in other life activities, as the process goes on the vocal part should drop out gradually, that is, the child should soon learn to read silently. If he does not, there seems to be great danger in making a fixed habit of too much unnecessary articulation during silent reading, a habit that hinders the rapidity of silent reading afterwards.

As we progress through the grades we see how gradually silent reading surpasses oral reading and yet how often in school teaching do we see the teacher of the fourth, fifth, or even seventh grade emphasizing oral reading in her room, just as if she believed that every one of her children were destined to become elocutionists in later life. Again it has struck us that children in the fifth, sixth, and seventh grades often read aloud worse than children in still lower grades. So many of them hate to stand up and read and when they do so they slur their words as if the oral reading were too slow for them. And this may really be the case as our results would suggest, whereas in still lower grades the child cannot get the meaning faster than his oral reading and therefore he reads better orally.

We feel strongly that the advantage in silent reading would have been greater and would have shown itself much earlier in the grades, if it had not been for the strong influence of early training in oral reading to which most of our children are needlessly subjected. Silent reading should be taught much more and much earlier in our schools.

A SCALE FOR MEASURING ABILITY IN ARITHMETIC

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Nature of the Scale. The scale is designed to measure ability in arithmetical reasoning such as is involved in the solution of concrete problems. It is composed of a series of problems arranged in the order of steps of increasing difficulty. The steps are numbered from one to fifteen. There is one problem to each step with the exception of steps 2, 3, and 5 for which no problems of appropriate difficulty have been found.

The value of the problems was determined experimentally by a test made upon 2515 pupils in grades four to eight inclusive in twenty schools in five states: Maine, Wisconsin, Minnesota, Montana, and Washington.

In using the scale, the pupils are allowed as much time as they need to do as many problems as they can. Practically all pupils are able to finish in twenty to thirty minutes.

Scoring the Results. The score of a given pupil is the number of the highest step done correctly. If a pupil passes all steps up to and including the eighth and fails on all beyond eight his score is eight. If he fails on nine, does ten, and then fails on the rest, his score is nine. That is, he is credited with each additional step passed beyond where he first failed. The actual values of the problems in the scale are indicated in parentheses and do not coincide exactly with the step numbers. For ordinary purposes of scoring, however, they may be regarded as being identical with the various steps under which they are placed.

ARITHMETICAL SCALE A¹

The numbers in parentheses are the actual scale values of the problems.

Solve the following problems in the order given. Do all the work on the back of this sheet.

Step 1. (.4) Mary had 4 apples and her mother gave her 7 more. How many apples did Mary then have? Answer.

Step 4. (3.8) Sam had 12 marbles. He found 3 more and then gave 6 to George. How many did Sam have left? Answer.

Step 6. (5.9) John sold 4 Saturday Evening Posts at 5 cents each. He kept

¹Copies of this scale for testing schools may be obtained from the writer.

$\frac{1}{2}$ the money and with the other $\frac{1}{2}$ he bought Sunday papers at 2 cents each. How many did he buy? Answer.

Step 7. (6.7) If you buy 2 tablets at 7 cents each and a book for 65 cents, how much change should you receive from a two-dollar bill? Answer.

Step 8. (7.7) How many pencils can you buy for 50 cents at the rate of 2 for 5 cents? Answer.

Step 9. (9.2) A farmer who had already sold 1897 barrels of apples from his orchard hired 59 boys to pick the apples left on his trees. Each boy picked 24 barrels of apples. What was the total number of barrels the farmer got from his orchard that year? Answer.

Step 10. (10.3) A news dealer bought some magazines for \$1. He sold them for \$1.20, gaining 5 cents on each magazine. How many magazines were there? Answer.

Step 11. (11.3) In the schools of a certain city there are 2,200 pupils; $\frac{1}{2}$ are in the primary grades, $\frac{1}{4}$ in the grammar grades, $\frac{1}{8}$ in the high school and the rest in the night school. How many pupils are there in the night school? Answer.

Step 12. (11.7) If 3 and $\frac{1}{2}$ tons of coal cost \$21, what will 5 and $\frac{1}{2}$ tons cost? Answer.

Step 13. (12.9) A school in a certain city used 2516 pieces of chalk in 37 school days. Three new rooms were opened, each room holding 50 children, and the school was then found to use 84 sticks of chalk per day. How many more sticks of chalk were used per day than at first? Answer.

Step 14. (14.2) A girl spent $\frac{1}{8}$ of her money for car fare, and three times as much for clothes. Half of what she had left was 80 cents. How much money did she have at first? Answer.

Step 15. (15.1) John had \$1.20 Monday. He earned 30 cents each day on Tuesday, Wednesday, Thursday and Friday. Saturday morning he spent one-third of what he had earned in the four days. Saturday afternoon his father gave John half as much as John then had. How much did his father give John? Answer.

An ideal scale would be one in which a pupil would pass all steps up to a certain point and then fail on all steps beyond that point. We could then say that a pupil's ability in arithmetic is eight on this particular scale just as we can say that a pupil's height is four feet and ten inches. About one pupil in five, however, will break down at some point in the scale and then do one or more steps beyond that point. The method suggested here for scoring such records seems simple and fair. It gives a pupil credit for every step passed and at the same time penalizes him for every step missed.

Standards of Attainment. The following standard scores have been derived from the 2515 pupils mentioned in a preceding paragraph.

Grades	3	4	5	6	7	8
June scores	4.6	6.2	7.8	9.4	11.0	12.6

Individual Differences and the Overlapping of Grades. The facts relative to the range of individual differences and the resulting overlapping of the pupils in the various grades are practically identical with those found for other subjects in which objective measurements have been made. The actual facts

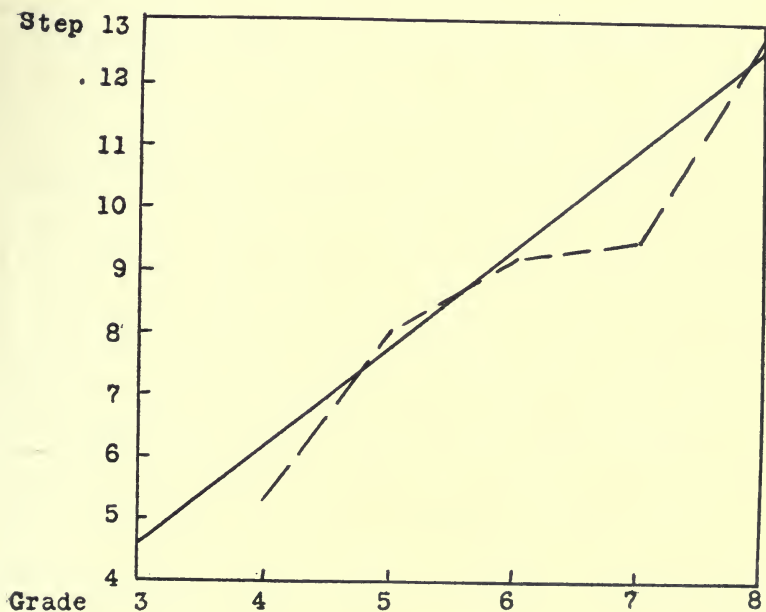


Figure 1. The continuous line is the standard curve. The broken line represents a school in a certain large city. The 7th grade is quite backward and is practically no better than the 6th grade.

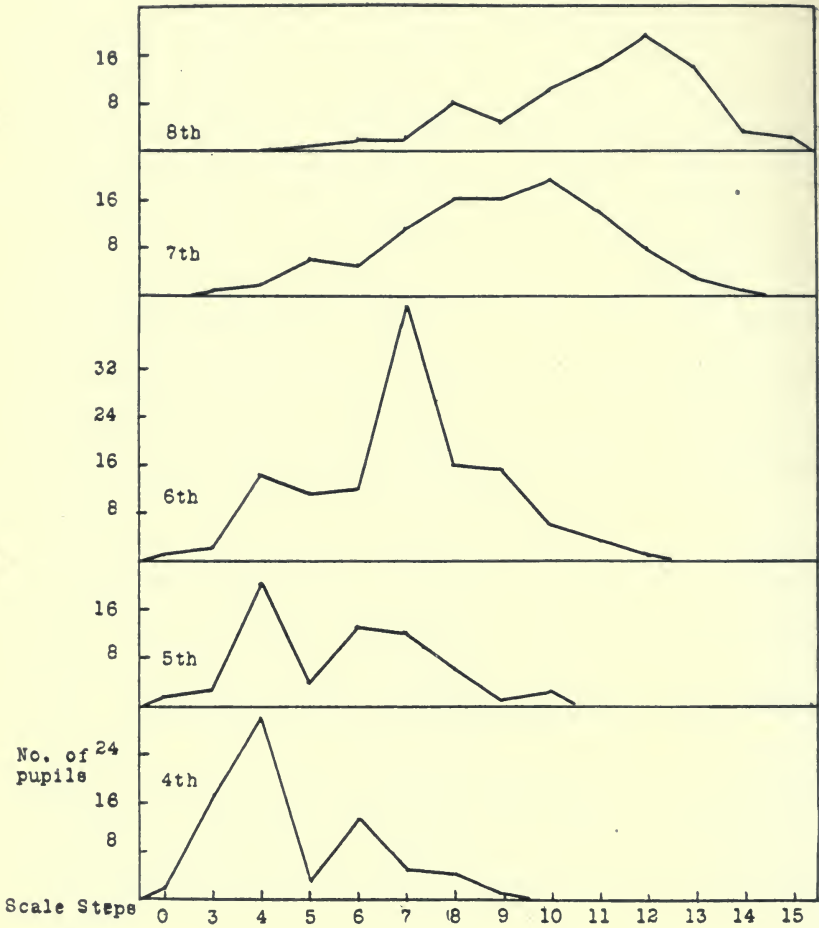


Figure 2. Distribution graphs of 429 pupils in two schools, showing the extent of the overlapping of the abilities of the pupils in successive grades.

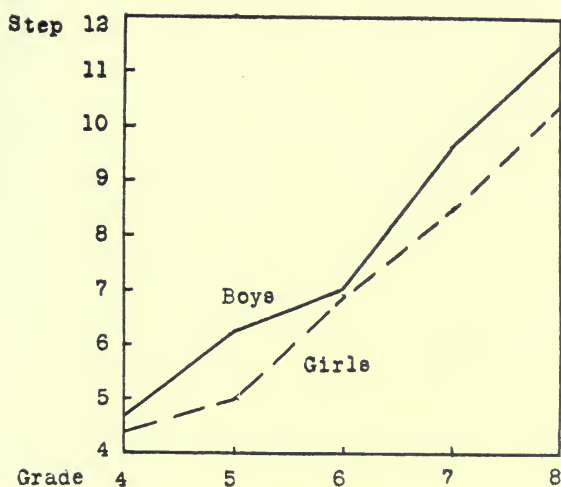


Figure 3. Sex differences. The continuous line represents the boys and the broken line represents the girls in two schools with a total of 429 pupils.

are shown in Figure 2. The graphs are drawn with reference to the same base line so that direct comparisons as to the range of ability and the amount of overlapping may be made. An inspection of the graphs shows an enormously wide range of ability and reveals the fact that the pupils in any given grade are distributed almost over the entire scale. In the sixth grade, for example, they range all the way from step 0 to step 12. The facts are expressed in numerical terms as follows:

In the 4th grade	33%	of the pupils reach or exceed the median of grade 5
" " 5th "	33%	" " " " " " " " " " 6
" " 6th "	22%	" " " " " " " " " " 7
" " 7th "	12%	" " " " " " " " " " 8

Corresponding percentages of pupils in the various grades fall down to or below the medians of the next lower grades.

Sex Differences. A comparison of the sexes shows that the boys are superior to the girls by amounts indicated in the curves of Figure 3. If we express the difference in terms of the amount of overlapping of the distribution curves for boys and girls we find that

In the 4th grade	50%	of the boys reach or exceed the median of the girls
" " 5th "	76%	" " " " " " " " " " "
" " 6th "	50%	" " " " " " " " " " "
" " 7th "	71%	" " " " " " " " " " "
" " 8th "	55%	" " " " " " " " " " "
<hr/>		
Average	60%	

Apparently the boys are superior to the girls in the ability to solve arithmetical problems. This fact is striking in view of the earlier finding that the girls are either equal to or superior to the boys in speed and comprehension of reading, in speed and quality of writing, and in ability to spell.

Derivation of the Scale. A series of thirteen problems composed partly of originals and partly of some used by Courtis, Stone, and Thorndike, was arranged roughly in the order of difficulty by a brief preliminary test. These problems were then used with the 2515 pupils in the twenty schools mentioned previously. The results were tabulated to show the percentage of pupils in each grade who had done each of the problems correctly. These results are given in Table 1 in the upper horizontal row for each problem. One of the thirteen problems is omitted from Table 1 because it was found to be almost identical in difficulty with problem six. The scale values of the problems were then computed from the data in Table 1 according to the following plan.

TABLE I.

The percentage of times (upper figure) each problem was done correctly in each grade and its P.E. value (lower figure) with reference to $M_6 = 0$.

Grades		4	5	6	7	8	Average P.E. Value	Re- quired P.E. Value	Actual scale Value
Problem	1	94.1 -4.20	96.9 -3.43	97.6 -2.95	98.7 -2.45	100.	-3.26	-3.00	.4
"	4	67.7 -2.58	86.5 -2.29	88.1 -1.75	96.4 -1.82	95.8 -1.00	-1.89	-1.80	3.8
"	6	27.7 -1.02	61.0 -1.08	79.7 -1.22	89.0 -.98	92.8 -.60	-.98	-1.00	5.9
"	7	20.1 -.65	51.9 -.74	60.1 -.38	80.6 -.45	88.9 -.25	-.49	-.60	6.7
"	8	16.9 -.47	39.9 -.27	52.8 -.10	78.3 -.35	90.8 -.41	-.32	-.20	7.7
"	9	1.8	24.8 +.44	49.1 +.04	65.5 +.26	78.7 +.40	+.29	+.20	9.2
"	10	2.7 +.96	20.0 +.59	34.6 +.58	52.9 +.74	71.5 +.73	+.72	+.60	10.3
"	11	1.1	9.3 +1.31	24.8 +1.00	41.8 +1.17	63.4 +1.05	+1.13	+1.00	11.3
"	12	.00	4.5 +1.84	18.8 +1.32	47.5 +.93	66.4 +.94	+1.26	+1.40	11.7
"	13	.10 +2.70	4.2 +1.89	15.4 +1.51	39.5 +1.24	58.5 +1.24	+1.72	+1.80	12.9
"	14	.5 +1.91	1.1 +2.74	3.5 +2.70	19.3 +2.13	38.9 +2.00	+2.29	+2.20	14.2
"	15	.00	1.5 +2.56	2.9 +2.80	10.7 +2.70	26.2 +2.51	+2.64	+2.60	15.1

On the assumption that arithmetical ability is distributed according to the probability curve, we are able to compute the scale value of each problem for each grade from the percentages of Table 1. These values will be expressed in terms of the probable error and the value of the probable error will be taken as 1.00. Thus in the 6th grade, problem 1 is gotten right by 97.6% of the pupils. Let us consider the median of the 6th grade as 0 and all distances to the left as minus values and all distances to the right as plus values. Now turning to a table

of P. E. values,² we find that the point which includes 97.6% of the cases of the distribution curve lies 2.95 P.E. out from the median, and since it is gotten right by more than 50% of the pupils its value lies to the left of the median and hence is -2.95 P.E. Similarly the value of each problem in each grade may be expressed in terms of P.E. values.

In order, however, to make the values for one grade comparable with those of other grades, it is necessary to determine the distances between the medians of the various grades. For example, it is necessary to know how far the 7th grade median (M_7) is to the right of the 6th grade median (M_6), and how far M_8 is to the right of M_7 . Likewise it is necessary to know how far M_5 and M_4 are to the left of M_6 .

The distances between the medians of the various grades were determined from the values of the problems in Table 1 as follows: The P.E. value of problem 1 in the 6th grade is -2.95 , in the 5th grade it is -2.77 . Hence so far as this problem is concerned M_5 is as much to the left of M_6 as the difference between the P.E. values of this problem in the two grades indicates, or .18 P.E. The P.E. value of problem 4 in the 6th grade is -1.75 and in the 5th grade -1.65 . Hence for problem 4, M_5 is .10 P.E. to the left of M_6 . In this manner the distance between M_5 and M_6 was determined for each problem. The average of these differences was taken as the actual difference between the medians of these two grades. By exactly the same computation the differences between the medians of the other grades were determined in terms of P.E. These were found to be as follows:

$$\begin{aligned} M_8 - M_7 &= .72 \text{ P.E.} \\ M_7 - M_6 &= .85 \text{ P.E.} \\ M_6 - M_5 &= .66 \text{ P.E.} \\ M_5 - M_4 &= 1.24 \text{ P.E.} \end{aligned}$$

Hence, if we take M_6 as the point of reference and call it 0, the positions of the medians of the various grades will be as follows:

$$\begin{aligned} M_4 &= (M_6 - M_5) + (M_5 - M_4) = -.66 \text{ P.E.} + (-1.24 \text{ P.E.}) = -1.90 \text{ P.E.} \\ M_5 &= -.66 \text{ P.E.} \\ M_6 &= .00 \text{ P.E.} \\ M_7 &= .85 \text{ P.E.} \\ M_8 &= (M_7 - M_6) + (M_8 - M_7) = .85 \text{ P.E.} + .72 \text{ P.E.} = 1.57 \text{ P.E.} \end{aligned}$$

² THORNDIKE, E. L. *An Introduction to the Theory of Mental and Social Measurements*. (1913) p. 200.

From these values we are now able to compute the P.E. value of each problem in each grade with reference to M_6 , which equals 0, as follows:

The P.E. value of problem 1 in the 6th grade is -2.95 . The P.E. value of problem 1 in the 5th grade is -2.77 with reference to M_5 , but M_5 is $-.66$ P.E. to the left of M_6 . Hence the value of problem 1 in the 5th grade is $-2.77 + (-.66)$ or -3.43 with reference to M_6 . Likewise the value of problem 1 in the 4th grade is -2.32 with reference to M_4 but M_4 is -1.90 P.E. to the left of M_6 . Hence the value of problem 1 in the 4th grade is $-2.32 + (-1.90)$ or -4.20 P.E. with reference to M_6 . In the 7th grade the value of problem 1 is -3.30 with reference to M_7 but M_7 is $+.85$ P.E. to the right of M_6 . Hence the value of problem 1 in the 7th grade is $-3.30 + .85$ or -2.45 with reference to M_6 . Since problem 1 is gotten right by 100% in the 8th grade, its value can not be determined in the 8th grade. The average P.E. value of problem 1 in grades 4 to 7, which is -3.26 P.E., will be taken as its actual value.

In a similar manner the P.E. values of all problems have been computed and are given in Table 1, the second horizontal row for each problem. The average P.E. value of each problem is its scale value. A distance of .40 P.E. has been chosen arbitrarily as the distance between the steps of the proposed scale. This particular distance was selected because the actual P.E. values of the problems conform most closely to steps separated by this amount. Table 1 gives in the columns on the right the actual P.E. values of the problems, the required values for the various steps, and the actual values of the problems expressed in terms of the proposed steps.

It remains to point out the difference in method and principle employed here for determining the location of the grade medians with reference to one another, and the method employed by Buckingham in his work on spelling.³ Buckingham determined the distances between the grade medians by considering the words as of equal value, by constructing a distribution curve for each grade, and by ascertaining then the amounts of overlapping of the curves of the various grades. This method involves two serious errors. The first is that of regarding all

³ BUCKINGHAM, B. R. *Spelling Ability*. Teachers College, Columbia University.

words as of equal spelling difficulty, the very point which the investigation attempted to ascertain and disprove. The second is that the words employed were far too easy for the upper grades which produced a contraction of the distribution curves at the base line which in turn produced an apparently greater distance between the grade medians than actually existed. The final scaling of the spelling words is distinctly affected by these two factors and thus made uncertain. The grade medians can be computed for the spelling test in the same manner as that employed for the arithmetical problems. By doing this it will be found that the distances between the grade medians will be considerably less than that found by Buckingham. The method employed here avoids the effect of the two factors mentioned above and assumes only that each problem has its own fixed value along a linear scale, and that the actual distances between the grade medians may be directly determined from the value which each problem has in each grade.

COMMUNICATIONS AND DISCUSSIONS

THE COLLEGE FRESHMAN AND MATHEMATICS

The college freshman, under the present system, is everywhere a variable quantity. But the professor of mathematics is face to face with a demand for a proper development in mathematical skill during the year, for the development of the ability to do accurately and quickly certain definite things in practical life, for a course that will give to the student a maximum efficiency. It is not sufficient that the individual be courteous, loyal, appreciative;—he must be more than this, he must be efficient in his work. This requires that he comprehend the problem more definitely, that he perform with greater celerity and perceive with greater accuracy. Yet what is the standard of efficiency that the professor has a right to expect at the beginning of the year, and at the end of the year? What is the growth in efficiency that the pupil has a right to expect? What course will best meet these requirements?

It has been with an idea of answering these questions, partly at least, that I have undertaken to test the mathematical efficiency of certain college freshmen which have come under my instruction during the past two years, and as far as possible to test their growth in mathematical efficiency when different tests are used, or the subject matter presented in different ways.

The experiment was begun with the freshmen in the fall of 1914, the course being required of all freshmen, and the sections formed entirely at random. The section meeting at 8:00 o'clock used Brenke's Advanced Algebra and Trigonometry for six months and Nicol's Analytic Geometry for the remainder of the year. The section meeting at 1:30 o'clock used Hawk's Advanced Algebra, Granville's Trigonometry, and Smith and Gale's Analytic Geometry. In each section approximately three months time was given to each subject, namely, algebra, plane trigonometry and analytic geometry, and care was taken to cover substantially the same topics and give to each topic approximately the same amount of time. During the nine months, seven tests in fundamental operations in arithmetic, algebra and trigonometry were used, some of which have been satisfactory, others have not.

In this paper the writer will give and attempt to discuss the results from two tests on fundamental operations, namely: the "Courtis Standard Tests in Arithmetic," Series B and Series A, form 3. The first test, which included twenty-four problems in each of the following: addition, subtraction, multiplication and division, was given to 93 pupils in the 7th, 8th, 9th and 10th grades in the Fairfield Public Schools and to 39 freshmen in Parsons College on October 14th, 1914, and to two sections of freshmen of 29 students each on October 6th, 1915. On November 25th, 1915, these same tests were given to twelve sophomores taking calculus. The tests were given to the grade pupils and the results computed by Miss Ruth Sumner. The other tests were given by the writer, and the tabulated results showing the average for each section are given below. Of the two sections for 1915, the record of the 8:00 section will be given first. The column indicating the number attempted in each operation is marked *att.* and the column indicating the number correct is marked *rt.*

Grade	Addition		Subtraction		Multiplication		Division	
	att.	rt.	att.	rt.	att.	rt.	att.	rt.
7th.....	8	5	9	7	8	5	9	6
8th.....	11	7	13	10	11	8	13	9
9th.....	9	7	12	10	11	7	11	10
10th.....	6	5	9	7	9	8	9	8
Freshmen								
1914.....	13.4	11.1	18.3	13	15.1	10.8	13.7	10
1915:8:00.....	12.2	9	15.4	12.4	13.2	10.	12.3	11.2
1915:2:25.....	10.4	7.7	16.	12.8	12.7	9.4	12.9	11.3
Sophomores								
1914.....	12.8	10	17.	14	14.6	11	14.5	14
1915.....	13	9.7	18.6	15	16	11	16.1	15

In these tests it will be seen that the 8th grade shows a decided gain in efficiency over the 7th grade, while the first year high school pupil was not more efficient in fundamentals than the 8th grade, and the 10th grade taking geometry has a decidedly lower standard. The results of the same test given to these pupils three months later indicated the same relative efficiency.

The freshman standard is decidedly higher than that of the grades and the sophomores show a substantial gain over the freshmen, and an average gain of about ten per cent. over their own record as freshmen. The individual variation in efficiency in the different sections was truly astonishing. Below is added what is in the judgment of

the writer the most efficient and also least efficient record made in each operation in each section. In each instance seventeen attempts with fourteen right is considered more efficient than twenty-one attempts with twelve right.

Section	Addition		Subtraction		Multiplication		Division	
	att.	rt.	att.	rt.	att.	rt.	att.	rt.
Freshmen								
1914 Highest...	24	22	24	22	24	22	24	24
Lowest...	11	0	9	3	8	3	9	3
1915 Highest...	24	24	24	24	23	20	24	22
Lowest...	6	3	13	5	7	4	8	7
1915 Highest...	22	16	22	20	23	17	20	20
Lowest...	6	2	9	3	7	4	6	3
Sophomores								
1915 Highest...	16	14	24	23	16	16	21	19
Lowest...	7	4	10	7	9	4	7	6

The above data do not show the extreme variation in every instance, as some of the most efficient completed the test in three-fourths of the time allowed. Yet each pupil whose grade is recorded above is a graduate of a fully accredited high school or academy and the present policy requires them to be taught in the same class. The record of the sophomore class for 1915 is quite uniform with one exception. One student always works very slowly, but thinks well, and is an acceptable student in calculus.

The second test, series A, form 3, included 8 tests, viz.: No. 1, addition; No. 2, subtraction; No. 3, multiplication, No. 4, division; No. 5, copying figures; No. 6, easy reasoning; No. 7, fundamentals; No. 8, more difficult reasoning. This test was given in each instance about six weeks after the test, Series B. It was given to the freshmen only and the tabulated results, showing the average number for each section, are given below:

Class	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6.		No. 7		No. 8	
						att.	rt.	att.	rt.	att.	rt.
1914	71	62.3	53	57.8	118.5	8.2	8	16	10	5.6	4.2
1915	69	55	56	57	115	8	7.5	16	11	5.5	4
1915	72	58.5	56	57	117	7.5	7	15.7	10	5.4	4.2

The uniformity of the average record of the three sections is quite striking. Yet the individual variation was very great. What is considered by the writer the most efficient and also the least efficient record in each operation is given below.

Class No.	1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
						att. rt.	att. rt.	att. rt.
1914	100	85	69	77	150	12 12	19 17	8 7
	41	42	31	29	93	4 4	14 4	3 2
1915	100	102	75	83	150	11 10	19 18	8 7
	51	40	40	40	82	8 2	13 3.5	2 1
1915	112	78	70	82	150	10 10	19 18	7 7
	40	32	37	35	80	4 1	9 3	2 0

It will be seen from the above data that the efficiency of the lowest record in terms of the highest record will average not over forty per cent.

In 1914 the two sections seemed to have nearly the same efficiency at the beginning of the year but the class (8:00 section) showed an efficiency of only 85% of that of the other section at the end of the year and exactly $\frac{1}{2}$ as many students from this section elected calculus in 1915 as from the other section.

The wide variations in efficiency in fundamental operations continued throughout the year and in general, not always, was indicative of the rank of the students as determined by the semester grade. The two results were, in general, in too close agreement to be mere coincidence.

EMERY E. WATSON.

Parsons College, Fairfield, Iowa.

TIMES OF WRITING EACH OF THE ARABIC NUMERALS DETERMINED BY THE REACTION TIME METHOD.

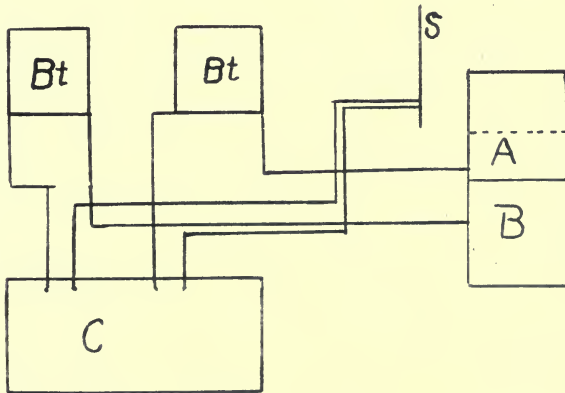
In constructing any arithmetic test in which all possible factors are to be controlled it is important that the time for making the figures to be written by the pupil should be evaluated. We know in a general way that it takes longer to make a "5" than it does to make a "7." If we are to construct examples upon a scientific basis, the relative difference between the times for making the ten Arabic numerals must be known more accurately.

Through the courtesy of Dr. James P. Porter, head of the Department of Psychology of Clark College, the above mentioned determination was made possible by the use of the Bergstrom Pendulum Chronoscope. In determining the times for making the different figures the following method was used:

A steel stylus S (Fig. 1), and two thin pieces of copper, A and B, partially superposed but separated by a sheet of tissue paper were introduced into the circuit with the chronoscope, C. The figures were made upon the surface of the upper piece of copper, A. When the stylus touched this surface the pendulum carrying the indicator of the chronoscope was started. The figure was made in such a way that the end of the last stroke brought the stylus off of the first surface on to the surface of the second piece, B. When the steel point made contact with the second copper surface the indicator of the chronoscope was stopped by its magnet and the time for making the figure could be read in thousandths of a second.

FIGURE I.

Diagram showing Chronoscope with connections used in determining time of writing Arabic numerals.



A and B --Copper plates
 S -- Stylus
 C -- Chronoscope
 Bt -- Batteries

After preliminary trials each figure was made twenty-five times on the first day. In order to corroborate the results of this first day's work, the experiment was repeated on the next day in exactly the same way. The following table gives the results:

TABLE I.

Median Times, Standard Deviations, and Probable Errors in 1000ths of a Second for Writing Each of the Ten Arabic Numerals.

Numerals	First Day			Numerals	Second Day		
	Median	S. D.	P. E.		Median	S. D.	P. E.
1	40.1	3.3	2.23	1	46	2.9	1.96
2*	224.5	8.6	5.8	2*	261	14.7	9.92
2	140.2	5.3	3.57	2	161.5	9	6.07
3	260	13.3	8.97	3	262.5	14.2	9.58
4	241	11.3	7.62	4	236	9.3	6.27
5	295	8.1	5.46	5	298	8.0	5.39
6	172.5	8.0	5.39	6	160	9.2	6.20
7*	259	16.3	10.99	7*	220	12.9	8.70
7	114	7.9	5.33	7	98	9.9	6.68
8	185.3	7.0	4.72	8	210	10.5	7.08
9	170.4	7.0	4.72	9	184	10.7	7.22
0	118	3.9	2.63	0	110.2	6.5	4.38

Although the manner of making the figures by the children in their school work cannot be controlled, it was thought advisable to make the figure "2" and the figure "7" in two different ways. The figure "2" was first made by using the preliminary loop which is sometimes used in the making of the figure. In the second case the preliminary loop was omitted. The figure "7" is also sometimes made with a preliminary stroke. The time for these figures was taken with and without such a stroke. The results show that this added movement increases very materially the time for making the figure.

In these experiments, the writer was the only subject. It is highly desirable that many more subjects of differing ages be used. This brief account is offered in the hope that some suggestions may follow leading to a more scientific construction of test examples to be used with out school children.

ARTHUR W. KALLOM.

Department of Educational Investigation and Measurement,
Boston, Mass.

* Preliminary stroke is used.

MENTALITY TESTS: A SYMPOSIUM

The suggestion of a symposium on this subject in the last number of the *Journal* has met with a most generous response. In order to give the discussion a definite impetus, a carbon of the manuscript for the note on this subject in the March number of the *JOURNAL* was sent to a few of the workers in this field. All of them responded immediately, and two volunteer responses came in addition. These replies are arranged in alphabetical order and must now speak for themselves. It is hoped that we may have reactions to these utterances and further contributions in the same spirit from many others who are entitled to an opinion in this gathering of the clan. All communications on this subject should be sent to the undersigned. As soon as a reasonable amount of material has appeared, some sort of analysis and general inventory of the situation will be made.

The workers in this field crave a sort of heart to heart talk, free from formalities and generous in self-revelation—an exchange of views which may fill the want strongly felt at the last meeting of the Psychological Association after hearing so many formal papers on this subject. It is important that we should think of these utterances as representing merely a fireside chat at a gathering of the leaders in this most promising field of work.

C. E. SEASHORE.

In reply to the suggestions of the Editor I submit a few comments on the present status of mental tests as I see it and upon certain desirable lines of development.

There is in the first place crying need for authoritative expression regarding the actual demonstrable achievements of the "test" movement. Reputable psychologists have, so far as I have observed, sinned but rarely in this particular, but the great rabble of "near psychologists," fake psychologists and their kith and kin, exploiting a newspaper press, always of easy virtue where a sensation or a scoop is in prospect, have poisoned the public mind with expectations which are at present, to say the least, utterly groundless. Already in certain important centers the failure to make good the promises held out has occasioned a vigorous reaction of public opinion which threatens to sweep away before its righteous disgust with the essential fraud perpetuated upon it, all that is at bottom really good and sound and wholesome in the mental test propaganda. Let us have

some frank speaking by our leaders regarding the real facts of the case. Unless this is done and done quickly, we shall have a needless battle on our hands, a battle to prove that the test which we are offering to assist in the solving of many educational and social problems is not in reality the discredited implement which an outraged public has already discarded.

In the second place let us inaugurate a campaign of conservatism in the inferences drawn even from such tests as are well-devised and carefully applied. Let us frankly recognize and clearly state that our enterprise is still in a pioneer condition and even with the best of correlative formulae and the most scientifically computed of distribution graphs, we cannot dogmatize with certainty regarding the meaning of our results. Science as well as art is long, and patience, that un-American virtue, is wholly indispensable.

Let us furthermore for once attempt some genuine scientific co-operation. The author's personal experiences do not make him very optimistic, but surely there is no "a priori" impossibility of distributing through a group of co-operating laboratories the attack upon just such problems of standardization as we are obviously facing in the test situation. Suggestions of the lines along which such co-ordinated effort might profitably proceed are abundantly contained in Professor Yerkes' memorandum and Professor Seashore's commentary thereon.

JAMES R. ANGELL.

University of Chicago.

Here in the Carnegie Institute of Technology and in several other educational institutions the departments of psychology are undertaking to make practical application of the methods of mentality testing. Their interests, however, is not centered in the defective or the abnormal or the child mind, but in the traits and abilities exhibited by students of college age with an intellectual status ranging well above the average of the adult population. Departments of psychology are being called upon to aid college officers (a) in selecting applicants for admission, (b) in classifying students, (c) in helping individual students to discover and remedy their own weaknesses, (d) in advising students in the choice of careers and in the election of studies, and (e) in placing students in the right jobs at graduation. Five years ago such a program would have seemed fatuous; and at the present time much less can be accomplished than certain fervent

believers in mentality testing have led some people to expect. But technique and available norms have been perfected to a point where the worth of mentality testing of college students is already proving itself.

For the successful prosecution of this program there is needed, first of all, a scale for measuring intelligence, with norms obtained from the most able and brilliant adults, as well as from the other ranges of ability.

The supplementary scales proposed by Yerkes and Seashore I should judge to be useful in the following order: first, ideational processes; second, affective processes; third, presentative processes; fourth, motor processes; and least important, receptive processes. But more important than any of these, if it could be made, would be a scale of conative abilities. Webb, in his recent study of "Character and Intelligence," has certainly made out a strong case for the existence of a second general factor in addition to the intellectual factor of general ability, a factor which would popularly be designated as "character" and which Webb suggests may take the form of persistence of motive. The scientist who makes a workable scale for measuring persistence of motive will take rank with Binet. The task seems fantastic, but no more fantastic than did the proposal in 1905 to have a graded scale of intelligence.

The most promising field for the immediate future I conceive to be in standardizing intelligence tests for adults. Our own program includes the preparation of percentile charts showing distribution of abilities in several traits, using for the most part tests and procedures already described. At the present moment we are particularly concerned with group tests which can be given to large numbers at once, to be used for rough preliminary mentality examinations. Next year the newly founded Bureau of Salesmanship Research will undertake to utilize these and other more elaborate tests in measuring the traits essential for success in high class salesmanship.

W. V. BINGHAM.

Carnegie Institute of Technology,
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(Extracts from a personal letter to C. E. S.)

I am now reading proof of a translation of practically everything that Binet wrote on the subject of measuring intelligence. We hope to have this on the market in May. I think this will be my contribution to the discussion.

Your symposium sounds like a good thing and undoubtedly it will be interesting reading, but I really do not look for any great unanimity until more people get down to solid work on the problem.

It seems to me that there are two ways of attacking a problem like this. One is to begin at the beginning and put one's self through a complete evolution of thought in the matter, making all the trials and errors necessary before one arrives at the final truth. The other method is to make as complete use as possible of all that has gone before, to begin where the pioneers left off. I began by the former method because I was unfortunate enough not to find the great and important work that was being done elsewhere. However, I did find it after a while and since then have been trying to go on where Binet left off. There is no real reason now why anyone else should follow the first method unless he chooses to do so, and yet, as I see it, most students of the problem of measuring intelligence are doing just that. We shall find eventually that they will all come out to the point where Binet left the matter and then if they live they will be able to go on further. It seems to me it is rather a pity that more who are interested in the matter do not take the other course and profit by all of Binet's work and go on where he left off. Terman and Kuhlmann seem to be doing this. I, myself, as you know, am not working on the testing of intelligence but am studying the feeble-minded. I use the Binet tests because they are so far the best that have been produced. Just as soon as something better appears I shall certainly use it, but by present methods progress is very slow. There are some other methods available and I am constantly trying to help out where it is necessary by other tests than those of Binet, but Binet is the main reliance with me as it is in actual fact with a large number of those who criticize him most severely. We cannot get away and never will get away from the mental levels as established by Binet. You will perhaps ask, as others have, why I hold so solidly to Binet. I think it is because I had had several years experience with the feeble-minded before I knew of Binet's work in this line, and have had more experience since, and I never cease to marvel at the wonderful insight Binet had and the amazingly accurate results that he obtained. In other words, I have found from nearly ten years living with the feeble-minded that Binet was correct in his theories of the feeble-minded and of their psychology, to a much greater extent than is given to most mortals. When one has been able to check a man up and find him almost universally wise and correct in his theories,

one comes after a while to the point where he does not feel it necessary to question anything that he says unless one has right at hand the facts that contradict him.

HENRY H. GODDARD.

Vineland, N. J.

Regarding the question of age standards. Age standards have to be set up in order to make a test usable for diagnostic purposes either by arranging the tests according to ages, as in the Binet Scale, or by determining standard scores for the various ages in tests or test groups which are not themselves arranged according to age. In the one case the age standard is used directly and is incorporated into the arrangement of the test series; and in the other case it is used indirectly. In the latter case a score must be determined in absolute or percentage (point scale) terms, and then transmuted into terms of age progress by comparing it with the standard absolute or percentage scores by ages.

Absolute or percentage score can be interpreted directly if performance in the test is not affected by age. Otherwise it is obvious that any particular absolute or percentage score would mean one thing for a child of one age and another thing for a child of another age. It would simplify matters then if we could use tests which are relatively little affected by age differences. It is true, as Seashore asserts, that we approach this condition when we examine the elemental capacities, as pitch discrimination, discrimination of two points, scope of attention for simple objects, and probably color discrimination. In such simple traits we appear to be able to approach a measure of individual differences among persons of different age. But the differences we obtain are of the least significance for intelligence, as it appears from the studies of several, among them Seashore himself, Norsworthy, Simpson and Burt, that the simple sensory and motor tests are correlated least with other measures of intelligence. It is in the more complex functions, which develop more with age, that the chief indications of intelligence are to be found. In other words, the capacity for learning, which is responsible for the greater part of progress with age, is closely related to intelligence. An intelligent child differs more at different ages than a stupid one. Hence functions which show marked development with age must be the chief subjects of intelligence tests.

The chief difficulty with the Binet scale, so far as its general form is concerned, is not that it is organized in age groups, but that the score is not analyzable. It lumps together scores on too many different functions, and not the same functions throughout the scale. Others have already proposed the remedy, which is to organize a series of graded tests all of which are to be given to all ages (or all ages within a certain definite period). A score can then be given in each type of mental process, and either by reference to age norms or by virtue of the fact that the score is in terms of age, the child can be given a qualitative rank which expresses his relative strength and weakness. For purposes of general ranking the individual scores can be combined.

To make any scheme usable for diagnostic purposes, the norms will have to be adapted to the particular social and perhaps racial group to which a child belongs. This is just as necessary for the interpretation of a point scale as for any other.

Different degrees of merit in an answer should be taken account of in the score.

A test arranged so as to constitute steps of increasing difficulty, the score to be based on the last step successfully attempted is very convenient when the nature of the task permits this form of organization.

FRANK N. FREEMAN.

University of Chicago.

The avidity with which the Binet-Simon tests have been seized upon and used in many countries, is striking evidence of the need there is for this sort of application of psychology. These tests were devised for a local purpose in Paris, to separate the mental defectives from the normal children in the schools. They have been extended into the examination of every sort of social misfit in hospitals, courts, and correctional institutions, and in the schools.

It is patent to most persons working in this field of applied psychology, that we are waiting only for an improvement in methods of measurement and analysis, in order to make a wonderful extension of this species of psychological measurement into the field of vocational guidance. We all realize that psychology should be the guide of educational practice in the realization of the most desirable socialization of the individual. We also realize that the analysis of the mental equipment of our best endowed children, in order that they may be effectively trained for the highest service, is vastly more

important than the analysis of defectives and delinquents. A better psychology will procure us a better education. Education awaits this extension of psychological measuring methods in order to become, itself, a real science.

Since psychology became an empirical science nearly forty years ago, mental examinations of insane subjects have been made along psychological lines of division of mental processes. Psychiatrists compare the scope and span of attention of their patients with those of normal subjects. Likewise they attempt to measure the association, the reproductive and constructive imagination, the inventive capacity, the judgment, and the self-control, of psychopathic subjects in terms of the same functions as exhibited by normal persons. In the same way the emotional life, the irritability, the distractibility, the influenceability, and the steadiness of purpose are compared with the like attributes of non-psychotic subjects. All these endeavors of psychiatrists indicate the eagerness with which they would welcome some really psychological measuring instruments for these various attributes of human nature which they find distorted and perverted in their subjects.

The staunchest champions of the Binet-Simon method acknowledge it to be a rough and inaccurate means of measuring intelligence. It is destined to appear crude and more primitive, as more scientific methods of measuring character development are devised; and such are certain to be forthcoming.

It was the dash of a genius in Binet when he conceived the simple way of measuring intelligence by the years of a child's life. The application of this measuring scale of intelligence has made possible not only comparative statements of degrees of developments of intelligence of feeble minded individuals and of other exceptional children, but it has also opened the way for devising and standardizing measuring instruments for all the mental processes which enter into the structure we call character. We stand at the opening of an era of great progress in the application of psychology in the study of the development of personality. Where we are now measuring the *intelligence of aments*, we are soon to provide ourselves with measuring instruments for measuring every kind of mental capacity which enters into the *social efficiency of the individual*. These species of measurement will be seized upon by psychiatry and education.

The year scale is unpsychological. It presents a good plan for distinguishing stages in development of infants and very young children.

In such mental development must be registered in terms of movements and actions. Scraps of information such as right and left, and of what sex he is may well supplement these movements when language has been acquired. But middle childhood cannot be best measured mentally by those other scraps of information, such as date of birth, day, month, and year at examination, days of weeks, and months of the year. Mere knowledge can not be constituted an index of mental development. The developing mind is a developing set of capacities to function. We must measure these capacities to function. And the only known way to measure a mental function is in terms of itself; that is, one exhibition of a functional capacity must be stated in terms of some other exhibition of the same.

Yerkes made a definite forward step in the matter of mental measurements when he put the Binet material into the form of a Point Scale. The Point Scale puts this matter into shape for comparative studies of mental capacities of one individual with those of others. It enables one to measure the individual performance in the terms of performances of groups of persons of his age, sex, and social status. It affords a real comparison of mental capacities. The measuring rod of the group is laid upon the individual.

Yerkes' present aim for three different short scales for infants, children, and adolescents and adults, will commend itself to all who have worked with the Yerkes-Bridges Point Scale. Some of the simpler tests constitute a waste of time for adolescents, while for young children many of the higher tests are so difficult as to discourage them. The next step is therefore such a distribution of the material now in hand, as to make these three different short scales, each administrable in thirty minutes or less. This development will not be one of lasting moment in the development of the processes of mental measurement. It will, however, facilitate the making of such measurements as are now possible. It will contribute to the speed and accuracy of such measurement as is now demanded by the exigencies of social life. It will do more than this, however. By facilitating current methods it will aid in accumulating data of value in devising partial scale for measurement of special mental capacities.

Psychology is not prepared to name these functions or capacities of the developing person, or to lay out in logical order the *kinds* of mental process which enter into the composition of character, much less is it able to exhibit the laws of mental growth. This lack in the logic of psychology is however no reason for abstaining from measuring

or from endeavoring to perfect our measuring instruments. Rather is it an incentive to push on to devise more accurate measuring methods. The application of these methods will inevitably advance the science of mental development. Botany does not refrain from physiological theories of the mechanism of plant metabolism, because it does not know precisely where and how the sap flows in trees. Measuring the direction and speed of flow of sap is a process which must precede an accurate physiology of plant life.

The logic of a science must develop as the complement of the accumulating facts of that science. The fundamental matter in all science is accurate observation. For this, measurement is indispensable. As progress is made, therefore, in measuring the phenomena of the growth of mental processes or of mental ability, the principles of the mechanisms of mental growth will emerge into view. The logical order and classification will emerge, as measurement progresses, and we shall see better what to measure.

Meanwhile we have a logic of psychology which we are not applying in our measuring activities. We have done little toward measuring by a Binet or a Yerkes method, the *emotional* and *conative* processes, which are unquestionably of great importance in the growing organism we call *character*. Measuring methods must be devised for these. We must measure mental development from all possible angles. We must devise *assay methods* which will reveal the *composition* of *human character*, at every possible stage of its development.

Because some of the *partial scales* for measuring intelligence promise to lead into regions of developmental psychology not previously touched upon by measurement methods, these and similar lines of research should be pushed with a view to finding tests which will measure the mental attributes and capacities not assayed by existing measuring scales. Such partial scales are Sylvester's standardization of the Sequin Form Board, Pintner's expansion of the Knox Cube test, and Miss Bowler's curtailment of Trabue's Completion test. Much promise lies also in Miss Bowler's pursuit of Decroly's Picture Story Arrangement, and in Pintner's standardization work with a variety of form boards and other performance tests.

THOMAS H. HAINES, M.D.

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In a situation such as ours, where mental diagnoses form the basis for practical social adjustments, there is a constant need for critical evaluation of tests as they really throw light on the most significant points of mental status and capabilities. We ourselves for long have been considering test results in the light of detailed case-histories, in the light of what we could learn of developmental conditions, previous education, environment, etc., up to the time of first testing; and later by comparison with further testing and the social outcome.

We feel strongly that, above all things, we need to know, as far as possible, how the findings on tests correlate with results in life. When this is done we find that conclusions often drawn from scheduled averages and norms do not hold true for individual cases, yet it is always just a single individual whose case is presented for diagnosis by the clinical psychologist.

(1) Of the present situation we think as follows: We cannot be satisfied with Binet-Simon measurement alone, even for rough diagnosis, except in cases of low grade feeble-mindedness. Many criticisms already made of these tests seem to us to be valid—reiteration of them is not needed—but we may offer a few general points of opinion:

(a) We do not feel satisfied with the separate tests themselves, even for rough diagnostic purposes. We feel that some of them might be replaced by better tests.

(b) We feel certain that, at least for our population, some of these tests are not rightly placed at age-levels.

(c) We feel that at several places these tests depend too much upon language and matters of information are unduly stressed.

(d) We have seen no particular reason for adopting any one of the revisions. None of these seems to show enough advantages over the 1911 series, nor obviate the difficulties inherent in the original. Indeed, some of the objections show even more strongly in the revisions.

Concerning age-level testing in general: We do feel that for certain cases rough interpretation by age-levels is highly valuable, although we are not prepared to say that a percentage grading might not be more justifiable. Of course, we regard as ridiculous the diagnosis of adults in terms of retardation from their chronological age, and we certainly find very definite reasons for disagreeing with the idea that the capabilities of older persons can be evaluated in terms of age-levels of "intelligence." The notion that capacity for giving testimony, or industrial efficiency, or ability in any special field can be

estimated by an ordinary age diagnosis, we find to be erroneous. Many elements of character and of capacity gained by world-experience are not so easily determined.

One important phase of the whole situation seems to us to be that some psychologists think of the possibilities of achievement and conduct in astonishingly and unwarrantably simple terms.

While we somewhat deplore the present lack of close co-operation between clinical psychologists, yet we see certain advantages at this stage through many working according to different methods and using different tests. None of us, as yet, knows sufficient for practical purposes.

(2) Our present procedure: We passed from the 1905 to the 1908 and then to the 1911 Binet series as they appeared. We adopted the latter in order to send to our State School diagnoses on the feeble-minded comparable to those made there. In order to keep our records equivalent we are still continuing the 1911 scale. We do not use the point scale because of practical time considerations.

In young individuals and among the lower feeble-minded we grade by Binet, plus school work and a few other simple tests. In all other instances we feel the urgent necessity of using a wide range of tests for special abilities, which, we find, begin to vary so greatly at 10 years or so of age. These often have much more significance for social implications than any age-level test. In special cases, such as those presented by the psychoses and neuroses, by defects in self-control, by educational and vocational problems, we vary and often greatly extend our procedure. We then use tests not only from our own series, but from many other available sources. We sometimes outline a detailed psychogram, which contains items of diagnosis and prognosis based on test results and other vitally important findings.

In our situation there is, unfortunately, perhaps, much more chance for a practically critical outlook on the interpretation of tests than for developing norms. Much of the standardizing of our own tests has been done outside of our laboratory. Through constant development of case-studies and follow-up work, we have, and shall continue to have, we hope, much practical and carefully worked-up material for future publication.

(3) Lines for future development of testing: We are convinced that there is need for much further experimentation, both with measuring scales and separate tests. We see many educational and vocational problems which are unanswerable as yet. With the idea often

expressed that there is little need for other tests, the need being only for further standardization, we certainly do not agree.

We believe that there should be steady development of a more critical attitude towards method, taking into account all the various adventitious conditions which may interfere with the examinee achieving the best results.

We also feel that there is much room for development of better interpretations, particularly in the light of years of follow-up work of special cases. Bearing on this is the vital question of how individuals who maintain themselves well in different grades of society react to tests. This problem of norms for social levels is hardly touched and, we fancy, will bring some valuable information when worked at.

(4) If there is to be as rapid advance as possible in the future, there must be much better co-operation between psychologists. It is a crude stage in the development of any science when workers are pulling in different directions and little cognizance is taken of methods and norms established by others. We would heartily favor special conferences on tests and testing.

WILLIAM HEALY AND AUGUSTA F. BRONNER.

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Chicago.

(To be continued in the May number)

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

INCLUDING EXPERIMENTAL PEDAGOGY, CHILD PHYSIOLOGY
AND HYGIENE, AND EDUCATIONAL STATISTICS

W. C. BAGLEY.

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EDITORIAL

Some time ago the superintendent of schools in Munich requested the teachers of certain grades in the entire city to ask each child to draw two sketches: one after a model and the other a free sketch. These were collected and sorted for the purpose of finding evidence of exceptional talent for drawing. A certain per cent. of the children whose exceptional talent for drawing had been thus revealed were sought out and informed of their power and promise, encouraged, and, where welcomed, aided in providing for special education in this field.

What was done in this very simple and inexpensive procedure for drawing could be done for plastic art and for music, within the field of art. It could also be done for special fields of industry which require well-defined talent for successful procedure. The cost would be entirely negligible and the gain would certainly be enormous.

There would be many by-products of such a procedure; the children, the parents, the teachers, and the community would be aroused to a recognition of the significance of the presence of unusual talent. The tests which would serve as a drag-net might well be made of such

a nature as to constitute a high order of training through an exercise in a specific subject. The training of teachers for the making of such tests would be more than compensated for by the stimulus for observation of talent that a specific exercise would give; having sought out one talent, a teacher would thereafter continually be in search for this and related talents which might otherwise pass unobserved. Early discovery of the child would make a specialized education possible at the right time and the child with a spark of genius might well be exempted from the drudgery of the hard and fast curriculum.

It has been said that one cannot suppress genius, but a genius once said something to the effect that most persons die with all their talent in them. Talent is the precious metal of the community and it is as important that we should distinguish the exceptionally talented individual in the early school life as it is that we should make a distinction between our rare and our baser metals. The present testing movement has here a new field somewhat parallel to that of the discovery of the defective and the working out of norms for the normal. It has been said that it is easy to obtain means for the study and care of the defective because you can make people weep over them. Why should it not be equally possible to secure the means for the developing of the exceptionally gifted child for the thrill of joy that a community should have in the discovery of such a possession? The investment will have to be made not so much in specialists or expensive institutions as in regular superintendents and principals who have a vision and know how to use modern means for the conservation of human energies.

C. E. SEASHORE.

NOTES AND NEWS

The London scientific weekly, *Nature*, speaks with approval of the efforts of certain members of Parliament to secure the appointment of a commission to inquire into the condition of education in England, with a view to securing a more adequate preparation for commercial and industrial life and a better adjustment to social and economic conditions. From another quarter dissatisfaction is voiced with the position of science in English education in a vigorous memorandum drawn up by a committee of the Association of Public School Science Masters. Perhaps after forty years of neglect, the counsels of Herbert Spencer regarding the position of science in education are to have some weight with his fellow countrymen, especially when the patent lessons of a world war are adding their reinforcement.

Mr. Stuart A. Courtis, well known for his standard tests in arithmetic, is engaged in perfecting a similar series of tests for geometry. These tests are seven in number including a speed test in copying figures, an exercise in the cancellation of a right triangle among numerous other types of triangle (recognition test), a memory test, a generalization test, an expression test, a logical relations test, and an exercise in stating the converse of a proposition and indicating whether this is true or not. It will be seen that none of these tests is strictly geometrical, and it will be of interest to see to what extent the results correlate with class standing in geometry. In the memory-test the pupil is to read the instructions as many times as he wishes before turning the sheet, but after he has once tried to carry out the instructions for any sentence he is not to turn to the instructions again but go on to the next. This situation places a heavy burden upon the pupil's honesty, and the reliability of the results may well be open to question. In the generalization test where the pupil is to indicate the common element in a series of five words, a difficulty lies in that some of the more difficult sets contain more than a single common element. A limited number of these tests are being supplied free to high school teachers who agree to turn over the results to Mr. Courtis.

At the University of Illinois lectures have been given recently before students of psychology and education by Principal Jesse B. Davis, of Grand Rapids, Dr. Helen T. Woolley, of Cincinnati, and

Dr. W. V. Bingham, of Pittsburgh. Mr. Davis explained the methods by which the schools of Grand Rapids were seeking to meet the needs of vocational education; Dr. Woolley explained the work in mental testing carried on by the Vocation Bureau at Cincinnati; Dr. Bingham spoke on "Making Psychology Practical."

During the month of March Professor G. M. Whipple lectured on "The Problem of the Gifted Child" before the Louisville, Ky., Teachers Association, the Southeastern Nebraska Educational Association and the University of Iowa.

The following news notes are taken from *School and Society*:

The Washington educational survey commission has selected Dr. W. C. Bagley, professor of education at the University of Illinois, as one of the two men who will conduct an investigation of the educational institutions of the state.

Leaves of absence at Harvard University have been granted for the second half of next year to Paul H. Hanus, professor of the history of education, and to Henry W. Holmes, assistant professor of education, and for the first half year to Walter F. Dearborn, assistant professor of education.

Dr. Herbert G. Lull of the University of Washington has accepted the position of head of the department of education at the State Normal School at Emporia, Kansas, and director of state training schools.

At Harvard University George E. Johnson has been appointed assistant professor, and John M. Brewer, instructor in education.

G. A. Bricker, assistant professor of agricultural education at Ohio State University, has accepted a similar position in Syracuse University.

PUBLICATIONS RECEIVED

ERNEST J. ASHBAUGH. *Handwriting of Iowa School Children*. Bulletin of the State University of Iowa. Extension Division No. 15. March 1, 1916. Pp. 24.

The author reports the collection of 28,000 samples of hand-writing from 110 cities, towns, and rural schools. The children were asked to write the sentence "Mary had a little lamb" at their natural speed and as well as they could for exactly two minutes. The papers were graded on the basis of the Ayres scale and the results indicated by grades and by groups in grades. Both speed and quality for different types of children are indicated in graphs, and the author concludes that on the average Iowa children write as well as any children of like grade elsewhere in the United States, and that 75 per cent. of eighth grade children are writing a satisfactory quality.

CLARENCE RAY AURNER. *History of Education in Iowa*. Iowa City: The State Historical Society of Iowa, Volume I, 1914, Pp. xiv, 435. Volume II, 1914, Pp. ix, 469. Volume III, 1915, Pp. xii, 464.

This is unquestionably the most complete history of education issued by any state, and in many respects is the most elaborate study of any aspect of educational development in America. The work was undertaken in 1912, and when completed will comprise six imposing volumes. As the editor of the series well says, "that the task of writing the first comprehensive history of education in an American commonwealth should have fallen to one so enthusiastic, so well-trained, and withal so experienced as Dr. Aurner is a matter of good fortune." The first volume presents a general historical introduction, the management of the public school funds, the formation of school districts, the appointment of teachers, and the selection of text-books in the schools. Volume Two traces the history of school supervision in Iowa and discusses state boards, teachers' institutes, teachers' associations, miscellaneous educational activities, and proposed legislation. Volume Three deals with the development of secondary education, taking up the incorporated and the unincorporated academies, secondary schools under sectarian domination, the public high school, and high school courses of study. The work constitutes a model of what a state history of education should be.

EMMA MILLER BOLENIUS. *Teaching Literature in the Grammar Grades and High School*. Boston: Houghton Mifflin Company, 1915. Pp. xv, 337. \$1.25.

In his editorial introduction, Prof. Cubberley points out that the early teaching of English was characterized by the effort to inspire

pupils and to awaken in them a love of poetry and prose. This was denominated "snap work" by teachers of mathematics and classics, and under the sting of criticism teachers of English went to the other extreme, reducing their instruction to a monotonous and almost lifeless type of intensive study. At the present time there is a marked reaction against making the study of literature "a grind." The present volume is an attempt to strike a golden mean between the extremes just mentioned. There are chapters on the ballad, the lyric, the metrical tale, the metrical romance, the epic, the drama, the short story, the novel, the essay, and the oration. In each one of these chapters the author takes up representative classics, largely those that have been recommended for college entrance requirements, and indicates how they may be taught so as to bring out the life and zest and interest in these masterpieces as literature. The teacher of English will find many interesting suggestions and valuable devices in the book.

LUCIUS MOODY BRISTOL. *Social Adaptation. A Study in the Development of the Doctrine of Adaptation as a Theory of Social Progress.* Cambridge: Harvard University Press, 1915. Pp. xii, 356.

Part One of this stimulating book furnishes a sociological background drawn from the works of Auguste Comte, Herbert Spencer, and the older sociologists. Part Two traces briefly the history of biological evolution, the Neo-Darwinians, and the environmental school of sociologists. Part Three presents the views of those who hold to a passive spiritual adaptation. Part Four regards even material adaptation as active, and Part Five considers the evidence for an active spiritual adaptation. It is an interesting thing to see the sociologists analyzing the phenomena of our complex social life from the same point of view and by the same objective methods that the biologists have applied in their study of animal life. To what extent the same principles hold is still an unsettled question, but the method of attack upon the problem leads one to hope for far-reaching results.

ROLLO WALTER BROWN. *How the French Boy Learns to Write. A Study in the Teaching of the Mother Tongue.* Cambridge: Harvard University Press, 1915. Pp. ix, 253.

The author in the course of long experience in the teaching of English became impressed with the thoroughness with which the French handled the problem of learning to write, and at the first opportunity spent a year in France for the purpose of studying at first-hand French methods of teaching composition. The present volume recounts the results of this study. There is a detailed discussion of the course of study, the methods of teaching composition, the attitude of the French toward formal grammar, the significance of literature, the

teaching of foreign languages, the preparation of French teachers, and the influence of organized language tradition in France. This latter factor exerts perhaps the most powerful influence upon the boy's developing French style. The lack of this factor in America is one of the chief obstacles with which teachers have to contend.

B. R. BUCKINGHAM. *Survey of the Gary and Prevocational Schools*. Extract from the Seventeenth Annual Report of the City Superintendent of Schools, New York City, 1914-1915. New York: Department of Education, 1916. Pp. 61.

At the beginning of the school year 1914-1915 two schools were organized on the Gary plan and six schools on the Ettinger (or prevocational) plan. In March and again in June, 1915, tests in arithmetic problems, grammar, geography, spelling, and history were applied to the eight schools to determine the status of the pupils in these subjects. The tests, the methods by which they were derived, and the detailed scores of the results are given in the report. Eight of the regular elementary schools were included in the experiment for check purposes. In practically all subjects the regular schools make the highest scores, the Ettinger (or prevocational) schools come next, and the Gary schools last. The author is careful to state, however, that the results should not be interpreted as a condemnation of the Gary principle.

A. FREDERICK COLLINS. *The Book of Stars*. New York: D. Appleton and Company, 1915. Pp. xv, 230. \$1.00.

This book was written to conform to the tests of the Boy Scouts, and the author's sole idea is to show the boy or girl how to become familiar with the heavenly bodies. While the astronomy presented in it is of the simplest sort, the easy style and the abundance of diagrams will stimulate the interest of even the dullest child, and will engender a desire to know more about the subject, and to look up points in larger treatises on astronomy.

ELLWOOD P. CUBBERLEY. *Public School Administration. A Statement of the Fundamental Principles Underlying the Organization and Administration of Public Education*. Boston: Houghton Mifflin Company, 1916. Pp. xviii, 479. \$1.75.

Part One presents a general outline of the subject, and deals with state, county, township, district, and city school organization and administration. Part Two is devoted specifically to the city school district and its problems, including the organization and function of the board of education, the duties of the superintendent of schools, the teaching corps, the courses of instruction, the testing of results, and the various departments of health, attendance, construction,

business, etc., which the modern school system necessitates. Part Three summarizes the results of city administrative experience and applies them to county and state organization. Each chapter is followed by a list of selected references, whose value is distinctly increased by the brief explanatory comment following each reference. The book will be found of great value to the student of educational administration.

CALVIN O. DAVIS. *The Subject-Matter and Administration of the Six-Three-Three Plan of Secondary Schools*. Ann Arbor: University of Michigan Bulletin, September, 1915. Pp. 35.

This is an excellent statement and discussion of the six-three-three plan with illustrative courses of study, comparisons with French and German plans, and a list of the towns that have recently adopted some form of this plan.

E. A. DOLL. *Woolley and Fischer's Mental and Physical Measurements of Working Children. A Critical Review*. Publications of the Vineland, N. J., Department of Research, No. 6, January, 1916. Pp. 20.

This is much more elaborate than an ordinary review, both in respect to the detailed examination of the material and the effort at constructive criticism of the investigation. The reviewer considers the monograph of great social and serious psychological influence, but laments the lack of orientation in the literature of the subject, the inadequate description of the children, and the arbitrary choice of tests.

BENJAMIN DUMVILLE. *Teaching—Its Nature and Varieties*. London: University Tutorial Press, 1915. Pp. vii, 446. 4sh. 6d.

In this discussion the author confines himself to general principles of teaching and does not enter upon a discussion of the teaching of specific subjects. The author presents a general view of education and of teaching, discusses the definitions of teaching as telling and as causing to learn, contrasts object teaching and the teaching of skill, and discusses the teaching of general truths, the teaching of reasoning, and inspirational teaching. While the treatment of the subject is largely philosophical, there are frequent references to the recent literature of experimental education.

The Educational Conference. Volume I, No. 2, 3, 4. Whitewater, Wis., 1915.

This little magazine is published bi-monthly during the school year by the Normal School at Whitewater, Wisconsin, in the interests of the teachers of professional subjects in normal schools. The sub-

scription price is 25 cents per year. In the number at hand are to be found an investigation of courses in the observation of teaching, educational psychology in the normal schools, ability tests at Whitewater, and many interesting educational notes.

WILLIAM F. FEAGIN. *Annual Report of the Department of Education of the State of Alabama for the Scholastic Year Ending September 30, 1915.* Pp. 176.

Perhaps the most interesting feature of this report is the account of the effort which the State of Alabama has been making to decrease illiteracy within its boundaries and to provide compulsory education for its children.

WILLIAM BYRON FORBUSH. *Child Study and Child Training.* New York: Chas. Scribner's Sons, 1915. Pp. vii, 319.

This is a very general treatment of child study, ranging all the way from what complete parenthood involves, through training in obedience, play, work, the bible and the child, the home and the school, amusements, money, and vocational guidance, to the development of religious ideals. An interesting feature of the book is the series of twenty-seven "laboratory experiments," as they are called by the author. These consist of questions and suggestions for the study of such topics as the interests of an individual child, a child's reading, crises in a child's life, the vacation problem, motion-picture shows, and the public library and the children. The book makes no pretensions to scientific treatment but promises to be of help to many earnest workers with children.

VINNIE C. HICKS. *The Hicks Series for Atypical Children.* San Francisco: Milton Bradley Company, 1915.

This is a novel undertaking to provide material for use in the training of defective children. It consists of a series of booklets, each containing about forty pages, with a story printed in large type and every third page left blank for drawings illustrating the story. The first book is entitled "The Farm Family." Others are "The Brown Children at School," "The Chicken Book," "The Action Book," which contains lists of verbs to be used as a game, and "A Number Story Book." "The Action Book" is supplemented by two sentence games, for which the material is supplied on large cards to be cut into small sections, and a set of word dominoes. A "Geography Story Book" is also contemplated. The material, particularly the sentence games and the word dominoes; represents a departure from traditional methods of trying to educate backward children, and promises to be of distinct value in the training of very young normal children. It is to be hoped that the author will follow up the material by the publication of data indicating the results of its application.

MABEL BETSY HILL. *The Most Popular Mother Goose Songs, with Illustrations in Color.* New York: Hinds, Noble and Eldredge, 1915. Pp. 44.

While this edition of Mother Goose may not have quite the artistic distinction of the Volland Edition, it has the distinct advantage of containing on each page the music to which the Mother Goose Melodies are to be sung. Both voice part and piano accompaniment are presented, and the illustrations are grouped very tastefully and artistically about the music.

K. J. HOKE. *Placement of Children in the Elementary Grades.* A Study of the Schools of Richmond, Va. Bulletin, 1916, No. 3. Washington: Bureau of Education. Pp. 93.

The monograph presents the age-grade progress of children in both the white and negro elementary schools, discusses acceleration and retardation, considers the effects of absence and age of entrance on school progress, and discusses the application of mental tests for the placement of children. The last thirty pages of the monograph present a detailed statistical study of the application of the Binet tests to 743 children. The results are tabulated in a variety of ways showing chronological and mental ages of repeaters, of non-repeaters, and of those who have skipped a grade. The work concludes with a strong plea for the more general use of mental tests in placing children in the grades.

H. L. HOLLINGWORTH. *Outlines for Experimental Psychology.* New York: A. G. Seiler, 1914. Pp. 109. \$1.00.

This outline has grown out of the author's experiences in teaching, and presents a brief analysis of each section of psychology with a list of selected references after each group of topics. The laboratory manual is designed especially to make use of the abundant material which has been coming from the various Columbia and other laboratories for the last ten years.

F. J. KELLY. *The Kansas Silent Reading Test.* Studies by the Bureau of Educational Measurements and Standards. Kansas State Normal School, No. 3. Pp. 37.

Part One of this booklet gives the three tests, the directions for scoring, and the distribution of the results obtained from applying the tests to 9252 children. Part Two explains the derivation of the tests and the method by which the value of each exercise was determined.

Kindergarten Training Schools. Bulletin, 1916, No. 5. Washington: Bureau of Education, Pp. 62.

A brief history of kindergarten training is followed by detailed statistics of training schools. A two-year kindergarten training course is suggested, and the ideals of kindergarten training are set forth by various eminent kindergartners.

AUGUST C. KREY. *Bulletin for Teachers of History.* University of Minnesota, 1915. Pp. 20. 25c.

This bulletin was prepared at the request of the College of Education to place before high school teachers a succinct statement of the problems connected with high school history and to suggest some of the more important materials and methods for dealing with it. The topics considered are the teacher's preparation, materials for the history course, and devices for the teaching of history.

THOMAS R. LOUNSBURY. *The Life and Times of Tennyson from 1809 to 1850.* New Haven: Yale University Press, 1915. Pp. xvi, 661. \$2.50.

This final work of the late Professor Lounsbury deals with the most interesting period of Tennyson's life. The book is the fruit of long and loving labor in a field in which the author stood pre-eminent. Some of the chapters were still unfinished when death overtook him, and the work of preparing the manuscript for the press fell to Professor Wilbur L. Cross. There is a brief sketch of Tennyson's early life, a chapter on his university days, an extended consideration of the literary trend of the period, an account of the poetic productions from 1830 to 1850, and a discussion of the sharp attacks of Christopher North.

ROBERT MACDOUGALL. *The Influence of Eye-movements in Judgments of Numbers.* Reprinted from the American Journal of Physiology, Volume 37, No. 2, May, 1915. Pp. 300-315.

The author's conclusions affirm the influence of eye-movements in our common judgments of number, and lead to the distinction of two types of factors, transitive (differences in color, brightness and size) and resident (the complex of kinaesthetic sensations aroused in connection with perception).

JOHN MACY. *Socialism in America.* New York: Doubleday, Page & Company, 1916. Pp. xi, 249. \$1.00.

The problem of the present study is set in the first chapter by the consideration of the attitude of the socialists in the present war. The author recognizes that the war is having a profound effect upon

socialism, and inquires whither it is to lead American socialists. There is a spirited account of American economic history, a statement of the program of the socialist party, a defense of the Industrial Workers of the World, and a plea to American socialists to work in the spirit of internationalism which their European brethren have discarded.

A. C. MONAHAN. *Free Textbooks and State Uniformity*. Bulletin, 1915. No. 36. Washington Bureau of Education. Pp. 67.

There is a history of the free textbook movement, a digest of the laws relating to free textbooks, and a discussion of uniformity within the different states. An appendix recounts the history of the state printing of textbooks in California and Kansas.

WALTER S. MONROE. *The Cost of Instruction in Kansas High Schools*.

Studies by the Bureau of Educational Measurements and Standards, No. 2. Emporia, Kansas, 1915. Pp. 35.

The author indicates what is meant by unit of instruction, shows how the cost of a unit of instruction is determined, discusses the factors that enter into such cost, and outlines standards for Kansas High Schools.

ERNEST CARROLL MOORE. *What is Education?* Boston: Ginn and Company, 1915. Pp. vii, 357. \$1.25.

The author states that this volume owes its inception to his efforts to teach college students and teachers how to study. In this he finds that one of the greatest needs is an elementary knowledge of the philosophy of education. In this book, therefore, he has attempted to set forth the fundamental presuppositions of education. There is a chapter on the doctrine of general discipline, another on learning by and for doing, and others on learning by problem getting, organization by selection, and learning to work by concepts.

RAYMOND PEARL. *Modes of Research in Genetics*. New York: The Macmillan Company, 1915. Pp. vii, 182. \$1.25.

This book is devoted to an examination of the underlying methodological bases of modern genetic science. Chapter One presents a critical examination of current modes of research dealing with the problem of heredity, the biometric method, the Mendelian standpoint, the psychological approach, and the embryological point of view. Chapter Two is devoted to the significance and limitations of biometric methods in biology. Chapter Three considers the nature of statistical knowledge; Chapter Four develops certain logical and mathematical aspects of the problem of inbreeding, and Chapter Five, on genetics and breeding, is a reprint of an address delivered as retiring chairman of the Animal Section of the American Breeders' Association.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

THE UNIVERSITY OF WISCONSIN SPEECH CLINIC

SMILEY BLANTON, M.D.

University of Wisconsin

The speech clinic organized at the University of Wisconsin in 1914 by Professor O'Neill was probably the first arrangement made to deal with speech disorders among college students. Since its organization the aim and scope of the clinic has been necessarily somewhat enlarged; the work with the students with speech disorders has led naturally to a consideration of what has been done for them in the past, and what is being done in the present kindergarten and primary schools. In this way the work of the clinic touches the field of general education and perhaps a review of the year's work and the plans for the future may be of interest to the general teacher.

Professor O'Neill felt that there was a great need to do something for the many students who had poor voices, unintelligent speech, or handicapping speech disorders. The work was so new and untried that it was not quite clear how best to adapt the work to the needs of the college student. After a year's work, however, the activities of the clinic have been sytematized, methods worked out, and aims and results can now be more clearly seen.

The following table shows the scope, and the number of students treated.

Stutterers 19 m. 4 f.....	23
Lispers.....	6
Indistinct Speech.....	4
Vocal Defects.....	24
Poor Voices.....	74
Fear Neuroses.....	2
Miscellaneous.....	2
Hysterical Phobia.....	1
Physical Affections of Nose or Throat.....	5
Total.....	141

One hundred and forty-one persons were treated, including eight members of the faculty.

The work of the clinic may be divided into four parts.

1. Treatment for poor voices.
2. Treatment for vocal defects.
3. Treatment for speech defects.
4. Training teachers for speech correction work.

Any student in the University, may receive treatment at the clinic. Each student treated has his history taken and is given a thorough medical examination of nose, throat, and larynx. Through the kind co-operation of the medical department of the University, the speech clinic is permitted to make use of the medical building and its facilities for examinations; and where knowledge of the student's general health is needed, it can be easily obtained by referring to the medical department's examination sheet of the case.

Under the heading "poor voices" are included all those who have to a marked degree monotonous or unexpressive voices, or who lack tone or inflection or vigor of speech. There are a great many in this class who wish a few lessons about how to use the voice properly but who do not wish to take the course in voice training. These students are formed into sections of ten to fifteen and given exercises to develop proper breathing for voice, change of pitch, inflection and the position of the articulative organs for the different sounds of the language. Each section meets for an hour weekly for ten weeks. Ten meetings are ordinarily necessary to acquire correct habits of breathing and speaking. There are always a few, though, who object to this tedious method and demand some short cut. These usually drop out after the first few meetings and naturally receive little good from the training.

Those suffering from vocal defects are given a very careful medical examination to determine any condition in nose or throat that might cause the defect. In some cases conditions are found that require medical or surgical treatment. After the examination sections are formed for vocal work. Aside from the section work as many thirty minute appointments are given as are required. At these appointments special exercises to fit the individual case are given and when necessary the patient is also given a thorough mental analysis. Some of the vocal defects:

met with were—"very hoarse voice," "husky, squeaky voice," "falsetto, childish voice," "voice breaks when speaking." All of these vocal defects were of so severe a nature as to seriously interfere with the patients' work. A faculty member could not make his classes hear, so hoarse was his voice. One student could not major in the subjects desired because of a "squeaky, husky voice."

These abnormal conditions of the voice are but *symptoms* of mental or physical conditions. The physical causes of vocal defects are diseases or malformation of the chest or air passages, the mental causes are lack of poise, or the presence of pathological emotional conditions. In a majority of the cases the mental causes predominant were worry, habitual anxious state and nervous strain, from fear of speaking. All of these emotions express themselves through tension of the vocal mechanism causing defects. For example: a girl in the second year class had a very high pitched, almost falsetto voice. The tones were querulous and whiney. The vocal cords were over stretched and there was some infection of the tonsils but there was no physical abnormality severe enough to account for the condition. Investigation showed the cause to be that she was taking more work than her strength justified, she worried about her work constantly, she was anemic, took little exercise and felt she was carrying the burden of the world upon her shoulders. There was also a certain youthful satisfaction and a kind of grim joy over the thought of the hard time she was having.

Another case was a boy also of the second year, with a weak, hoarse voice; he was so timid and sensitive that whenever called upon to recite he became so frightened that he lost control of his breathing and his voice quite failed him. He was able speak only with great effort, and this strain gradually affected the vocal cords. Vocal re-education or medical treatment alone would be of little benefit in such cases. Exercises for relaxation must be given, and the breathing apparatus must be trained for its value in controlling emotions and inducing poise, and last in the conferences the patients must be convinced in what respect their attitude and view point towards the world is wrong. In short there must be a more or less complete mental adjustment, as well as the gaining control of the vocal mechanism in order to eliminate vocal defects.

Under the heading speech defects are included stuttering (which includes stammering), lisping and indistinct speech. Indistinct speech, when it is not due to some malformation of the articulative organs, can usually be remedied through the use of corrective phonetics. Lispings, which is much harder to treat, may be divided into three kinds,—negligent, neurotic and organic. Negligent lispings may be treated in the same way as indistinct speech; the neurotic type requires that the general health of the patient be improved, so that there is more poise of the nervous system. In the majority of cases of organic lispings there is some malformation of the jaw causing an imperfect occlusion of the teeth which prevents the tongue from easily taking the positions required to produce the correct sounds. The remedy here is to correct the formation of the jaws through the teeth.

Stuttering is the most serious speech defect that the clinic has to deal with. The cases vary in seriousness from those who have only a slight defect to those who can scarcely speak a word without contortions of face or body. Stuttering is generally admitted by neurologists to fall into the class of the psychoneuroses, and its cause has never been satisfactorily determined. I believe that it should be regarded not as a disease but as we regard fever or pain, merely a symptom of a diseased condition. This diseased condition is due to some abnormal condition of the mind. I have never seen a case of so called physical stammering.

The treatment of stuttering consists of psychoanalysis and suggestion, supplemented by vocal exercises which are based on physiological laws and planned so as to train the three fundamental parts of the vocal mechanism,—the diaphragm, the vocal cords, and the articulative organs. Each stutterer is given an association test, under standard conditions, consisting of Jung's list of one hundred words supplemented by twenty words I have added. By a study of the words given in response to this test, and the presence of any inhibitions expressed in delayed or peculiar responses, a sort of bird's-eye view of the patient's personality is obtained, and also clews obtained to any complexes which may be present. Some ten or fifteen words that show inhibitions are selected and the patient is asked, while sitting quietly with eyes closed, to give all the ideas that come into his mind in relation to the complex words.

For example one stutterer gave the word "poor" sixteen times in the course of the test. When asked to give freely all the ideas associated with the word he said: "I am poor in many, many things; I have this idea so firmly that I do not like to go out and meet people; and not only am I poor in social relations but poor in college work, a little below the average. I always had the idea that others were better than I. My brother used to have great influence over me. I followed doggedly his suggestions. He used to show me that my ideas were not necessarily right, and I used to take his view point. He made me come out here, he arranged my course and made me take engineering. I always felt that I was the poor one in the family." We believe that stuttering in this case was chiefly a symptom of the deep feeling of inadequacy,—a feeling which had not been quite conscious until the association test showed to the patient how dominant was the idea "poor" in his mind. There were several other cases in which we found this deep sense of inadequacy. Before the stuttering could be cured the mental attitude had to be changed. Vocal re-education alone is quite useless.

When asking for associations with a certain word, great care is taken never to suggest anything, but to take only what the patient freely gives. After the test is over, if it is felt to be wise the facts discovered are laid before the patient and he is asked what is his interpretation of them. In the case just cited the boy was told that he had given the word "poor" sixteen times in one hundred and twenty words. He had already noticed that the word kept recurring, and he even became somewhat irritated over his involuntary repetition of it. His attention was called to the associations he had given in relation to the complex words and especially associations with the word "poor" and he admitted that he really did have a constant feeling of inferiority. Having made him realize this, an attempt was made to change his point of view and improve his confidence.

In some cases of stuttering a more definite cause was found, such as a definite phobia, mother or father complex, homo-sexual impulses. Some cases of stuttering are undoubtedly due to these causes and this is the type of case that the Freudian psychoanalysts are able to cure in a few conferences. But I do not agree with them in claiming that all stuttering is due to a definite mental trauma which can be relieved by psychoanalysis alone.

In a majority of the cases I have had, the cause was more general. Analysis revealed nothing that could be plucked out as a briar is from the hand. Perhaps this was due to the fact that the original complex causing the stammering was too deeply covered up to be brought to the surface.

I am not quite certain how much value to attach to vocal re-education though I am certain much good is accomplished, and this training has to be given in conjunction with the mental treatment in order to get the best results. In some young children, and in a very few adults vocal re-education alone suffices to effect a cure. But the vocal exercises should not be applied in a stereotyped way. Each case must be studied and exercises given that are needed in the individual case. For example some need breathing exercises most, others exercises for developing change of pitch to overcome the spasm of the vocal cords, others require articulatory exercises. The routine treatment of stuttering always produces poor results.

The most important work of the clinic, however, is not treating adults with vocal or speech disorders, but consists of training teachers for corrective speech work, who may go out into the schools of the state. People with speech disorders should receive training for their trouble while they are young. What can be accomplished by a well trained teacher is shown by these facts taken from the last June's report of a teacher who is engaged in this work. In the two schools in which she taught there were three thousand children, five per cent. of whom had some vocal or speech disorder. There were twenty-nine children who stuttered. After a year's treatment sixteen were reported normal. These cases were not reported cured until they were able to speak in their homes and in their classes without hesitation. Six were much improved, and only seven showed slight improvement. These results are not above the average. If taken early fifty per cent. or more of the cases of stuttering may be cured, and another twenty-five per cent. may be decidedly benefited. Even better results may be obtained in the other speech disorders. The great handicap in inducing schools to undertake this work is lack of knowledge among teachers and even among physicians concerning the matter. The belief that stuttering will be outgrown is widespread. It is true that a certain number of cases will get well through their own efforts at adjustment. But the

process of self cure is long and painful and can be much shortened by proper treatment and many cases will be unable to rid themselves of the defect without help.

Stuttering often causes an actual backwardness in school from one to three years. In other cases the child is able to keep up with his classes but at such a cost of mental and physical suffering that the nervous system is affected and the child quits school a neurotic for life. It is not hard to realize how inhibition of almost every speech impulse, the ridicule of playmates, the amused or pitying attitude which the child meets outside sometimes change completely the mental disposition. Stuttering prevents the individual from entering many a line of endeavor which he would like to enter as a life work. In the lower walks of life it hinders the making of a bare living. It is a fact that immigrants who stutter are rejected as they are considered likely to become public charges.

The State of Wisconsin has already made provision for training the children with speech disorders, and now there are eight cities in the state that have teachers for this work. It has been very hard to find properly trained teachers, but the speech clinic hopes to train enough teachers to supply the demand here in Wisconsin and perhaps in other states as well. During the last year four teachers were trained in the speech correction work; during the summer session twelve teachers who graduated from the training school for teachers of the deaf registered in the teachers' course. Ten of these are now teaching in the Wisconsin schools. The course consists of practical work in diagnosing the common speech disorders that occur in children, and the treatment of them; this is supplemented by lectures concerning the development of speech in the infant, the anatomy and physiology of the speech mechanism, abnormal psychology, and psychoanalysis. A thorough training is given in normal and corrective phonetics.

A study of the facts brought out by the investigations of psychiatrists and neurologists are of great benefit in understanding the normal as well as the abnormal child. In studying the neurotic symptoms that occur in school children as pathological lying, kleptomania, "sullen anarchy," incorrigibility, imperative actions, morbid disinclination towards certain topics in school, it is found that they are caused by the same abnormal mental

conditions that caused the stuttering. This general cause that is found back of nearly every neurotic trait and case of stuttering is unwise repression leading to mental conflict.

It seems that it is quite possible for the speech correction teacher, if properly equipped, to deal with the child with neurotic symptoms as well as those with speech disorders. This will require teachers of tact, experience and poise. The best results will be obtained where the teacher is supervised by a physician who is a specialist in this line, and children with severe symptoms should be referred to him. But there are many cases that the teacher can deal with alone. The physician for example has no time to treat a case of "sullen anarchy," or anxiousness or lack of concentration. Teachers trained for this work can accomplish a great deal of good in our schools, and can save many children from life-long suffering and failure.

ADDITIVE SUBTRACTION AND MULTIPLICATIVE DIVISION TESTED¹

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PRACTICE AND THEORY

If the Arabic numerals one to nine be arranged for addition in all their possible relations, forty-five combinations will result. These are commonly known in our primary arithmetic work as the forty-five addition combinations. Also, if we arrange the number tables in subtraction in all their possible relations up to eighteen, (including 0) we will have one hundred such relations. The multiplication and division tables, through nine, number ninety combinations each. Practically all of our teaching in the past has been toward the forming of as many separate number habit connections as a mastery of the separate tables made necessary. The operations were usually taught through new connections instead of old. Each table was taught by methods which did not allow of a utilization of previous mental connections. If, as pupils were becoming familiar with such combinations as "three and two are five" (or two and three are five), they were learning to subtract by such methods as "two from five leaves three," or "five less two is three," as many as one hundred forty-five separate mental bonds were being formed.

In the days of discipline psychology the time and effort were thought to be well spent, for a "general mental strength" was the result. Present day educational psychology seriously questions this general disciplinary theory. Many research studies lead the present day educator to the conclusion that general strength or "transfer" takes place only when we employ common or "identical elements" of material or method. The idea of general mental connections has given way to the separate neurone

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connection theory wherein each mental bond formed between stimulus and response calls for its particular synapse unless elements in common with previous connections are employed. An example of where a common element of material might function in different situations would be the learning of such words as "light," "night," etc., after a mastery of the stem phonogram "ight." To quote Ladd and Woodworth, *Elements of Physiological Psychology*, page 566: "In order for a transference of skill to occur from one performance to another, there should be, between the two, not simply likeness in the abstract, but some concrete part-performance in common, as there is between saying 'boot and book.'" An example of identical elements in method or process would be the finding of the difference between five and three by adding to three the number which makes five. This Thorndike would call, "identity of procedure." (*Educational Psychology, Briefer Course*, page 277.)

In this day of conservation of mental, as well as physical energy, the question arises: Of what good is it to teach one hundred forty-five addition and subtraction habits to perform two of the four fundamental processes if it be possible for us to make the forty-five combination habits do the work in both of these processes? And again, why teach a new set of division table habits if by using ninety multiplication connections pupils are able to do both multiplication and division through the nines? "To learn two forms for one thing, is a waste. Hence there is an increasing disposition both in general practice and among the more critical to utilize a single form in as many places as possible. Subtracting by adding is merely using the same association and word form for both addition and subtraction. Hence only one set of tables, instead of two, has to be learned. Dividing by multiplying is an analogous situation, though not so much employed in American schools as 'subtracting by adding'."²

This theory has been accepted by some of our recent texts and method books in arithmetic. Others have made mention of it, leaving it to the judgment of the teacher whether the new, additive or "making change" method should be employed in teaching subtraction, and whether pupils should be taught to divide by utilizing their previously formed multiplication bonds. That adults do in fact practise this method, in the case of sub-

² H. SUZZALLO. *The Teaching of Primary Arithmetic*, page 86.

traction, can be seen any day with the sales clerk or cashier. "The fact that in so many instances additive subtraction has been adopted unintentionally, seems to indicate that it is decidedly easier for the mind, and might well be taught in the schools."³ This method for subtraction dates back to Italy and the sixteenth century and is sometimes known as the "Austrian" method. "The efforts made to adopt it in the Austrian schools, and the consequent notice taken of it in Germany, have been the cause of its most inappropriate geographical name."⁴

The advocates of this new "subtracting by adding," rather than by the old "taking from" or "borrowing" method claim for the plan two decided advantages: (1) "it avoids the necessity of learning separate tables for addition and subtraction; and (2) it increases speed and accuracy in addition, as subtraction forms are immediately converted into addition associations."⁵ But while the faith of the bolder and more progressive spirits in education—and it is through them that progress is made—has been expressed for some years past in the method above described, the theory is not yet proved by actual tests. There is nothing as yet in print on this subject other than opinion based upon a most plausible psychological theory. "The only thing for the school to do, then, is to teach the method that will prove in the long run to be the most rapid and accurate, and this seems *a priori* to be the Austrian, although a scientific investigation of the matter, on sufficient data, is desirable." (Smith, *ibid.*) What then do school children actually do with additive subtraction and multiplicative division when tested over a series of months?

NATURE OF TESTS AND MANNER OF GIVING

With a view of evaluating the above theory, a four months' controlled test in additive subtraction was given to a second grade of the Garfield Public School of Cincinnati.⁶ Another second grade was taught by the old "taking from" or "less" method. One third grade was taught for four months by the multiplicative method of division. Another third grade divided

³ YOUNG. *The Teaching of Mathematics*, page 235.

⁴ SMITH. *The Teaching of Arithmetic*, page 46, Teachers College.

⁵ BROWN AND COFFMAN. *How to Teach Arithmetic*, page 160.

⁶ Acknowledgements for help in giving these tests are due to: Miss Winifred Humphrey, Miss Augusta Duerr, and Miss Dora W. Lyon of the Garfield School.

by learning the "division tables." In the school selected all the children who were studying German were placed in one class of the grade, and all who were studying English only, in another. There was, therefore, no attempt at selecting the brighter ones for one class, nor was there any reason to suppose that one class was of greater ability than another. In order to settle the question positively a preliminary test to establish initial ability was given. The teacher of the German second Grade, which will be called hereafter the "take away" group, or class, was asked to confine her teaching of subtraction to the following sample formula: $\frac{8}{6}$; the child always thinking the problem out as "eight less, or take away, two leaves six." All the one hundred combinations were to be learned in the same way, and all drill during the experiment was to be done according to what, for lack of a better term, was called the "take away" method. Any attempt on the part of the children to associate the corresponding addition combination was to be discouraged. The teacher of the English second Grade, which will be called hereafter the "additive" group, or class, was asked to teach subtraction as the natural complement of addition and inseparably connected with it. Her pupils, in answer to the question, " $\frac{8}{6}$, two and what make eight?" repeated the formula, "two and six make eight." The children were told that the subtraction sign meant "less" or "take away." They subtracted, however, only by adding. The pupils were frequently called upon to repeat the wording of the formula which was being followed by their group so that they might become habituated in it.

The same arrangements were made in the third grade, the teacher of the class studying German confining herself, in the teaching of division, to the "into" division method, and the following sample formula: $5 \overline{) 20}$, five into twenty goes four times evenly. The English multiplicative division class said: " $5 \overline{) 20}$, five times what are twenty? Five times four are twenty." The work of the third grade does not go beyond multiplication and division by five, so that only fifty combinations out of the ninety were used.

The four classes began their new work at the same time, about the first of February. The two second and two third grade classes

spent exactly the same amount of time, thirty minutes daily, in this formal work in arithmetic. As far as could be done, every difficulty that would make final comparisons impracticable was eliminated; there remained of course the possible differences of teachers in ability.

In order to determine the relative initial abilities of the four classes, a test in the addition combinations was given to all four classes before starting on the new work of subtraction and division. The manner of giving this preliminary test was exactly like that of all subsequent tests, except that the subject matter of the later practice tests was subtraction for the second, and division for the third grades. In the preliminary test, the forty-five addition combinations were printed on sheets of paper and arranged in sets of five, all sets, as nearly as possible of equal difficulty (after Courtis) in order that a child's progress might be steady, and that the one who solved thirty combinations might fairly be said to have made a score just twice that of the child who solved only fifteen. To eliminate differences in the giving of the tests, one teacher gave all of them, using exactly the same instructions for each class. Each child was given a paper turned face downward on his desk. The nature of the test was explained and the fact impressed upon the children that it was a race, each child with himself as well as with the others. At the signal all turned the papers over and worked for one minute, stopping at the signal. All the papers were collected, marked by the same person, and the scores of the individual children read to them, together with the combinations missed, in order that the child might master those before the giving of the test a month later. It was found best not to give the class scores to the teachers. Table I shows the results in medians, and probable errors. Figures I and II picture the table graphically.

TABLE I

	Take Away Subtraction		Additive Subtraction		Into Division		Multiplicative Division	
	Med.	P. E.	Med.	P. E.	Med.	P. E.	Med.	P. E.
Addition Test								
Feb. 9.....	6.7	3.5	7.7	3.6	19.0	6.4	7.2	4.1
March 9.....	6.5	3.1	8.5	2.6				
April 6.....	13.4	2.7	13.6	3.3	13.0	3.5	15.0	2.8
May 4.....	13.4	3.3	14.7	3.6	16.0	2.2	18.6	3.2
June 1.....	16.2	3.5	12.7	4.5	20.0	4.4	21.5	4.5
June 17.....	15.4	3.2	15.7	2.5	23.0	2.6	25.5	2.5
June 17.....					18.5	6.1	16.0	3.5

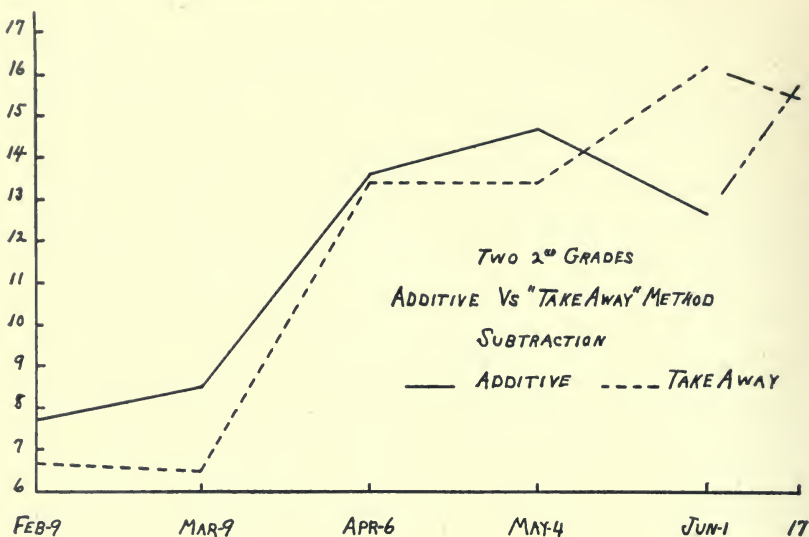


FIGURE I

Irregular lines at end represent transfer of ability to abstract examples of three figures.

INTERPRETATION OF RESULTS

The class which took up subtraction by the "take away" method showed an initial ability in addition of 6.7 combinations solved in one minute; the additive method class 7.7; the "into" method division class 19; and the multiplicative method division class 17.2. If one method is just as effective as the other, at the end of the experiment in June the additive class should stand about one point higher than the take away group, while the multiplicative division class should be about 1.8 below the other division group. Throughout the experiment median scores were used.

The March test could be given to the subtraction classes alone as the division classes had not mastered enough division combinations. This accounts for the break on the chart in the division line for March. The "take away" subtraction class showed a score of 6.5; the additive class 8.5. The former class had taken up a new process and might be expected to show a loss of ability. The additive class, taking subtraction as a mere matter of addition, had made a distinct gain in the month's drill.

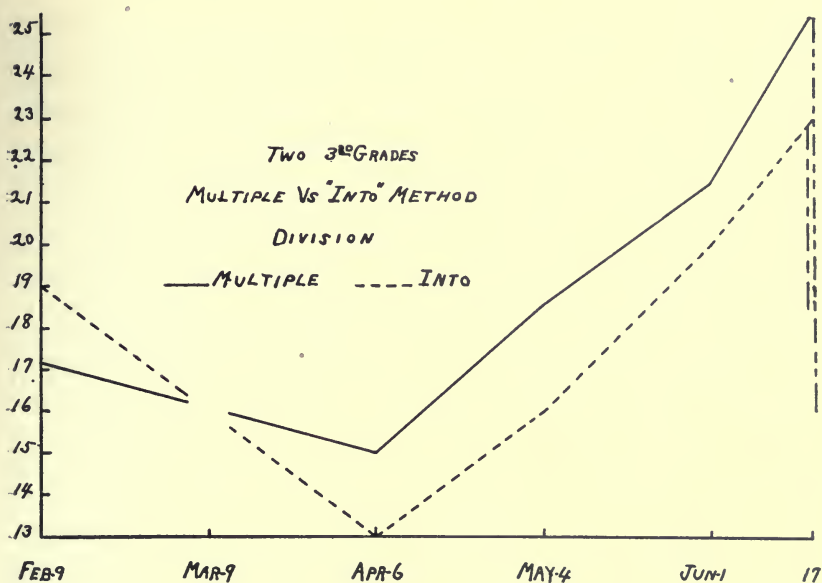


FIGURE II

Irregular lines at end represent transfer of ability to abstract examples of four figures.

The April test was given to both grades, the "take away" class showing a score of 13.4; the other group 13.6. The results in the subtraction classes were rather disconcerting. From the standpoint of actual scores, the "take away" class had almost caught up with the additive, but considering the one point difference in initial ability, it had surpassed the additive by .8 of a point. The two division classes were making their first score since the test for initial ability. With the taking up of a new process each showed a loss, that of the "into" class being much greater.

The May test showed the following scores: "take away" class, 13.4, with no change for the month's work; additive class 14.7, a gain of 1.1 points; "into" division class 16, a gain of 3 points; multiplicative division class 18.6, an absolute gain of 3.6, or a relative gain of .6 points over the "into" class. During the month of May the subtraction classes spent ten minutes each day on addition drill, pure and simple, and the two division classes the same on multiplication drill separate from their subtraction and

division work respectively. A gain in ability to add or multiply ought to show a gain in subtraction and division for the new method classes, while it would presumably have no effect on the old method classes. That the addition work proved confusing to the second grade additive pupils is apparent in the June results.

The test the first of June was the final one of the series for the subtraction classes. The "take away" class scored 16.2, with a gain of 2.8 over the month before, while the additive class scored only 12.7, with a loss of 2 points. If the methods had been equally effective the additive class should have stood one point above the take away class, while in reality its final score was 3.5 points below, or, considering the difference in initial ability, 4.5 below. The figures apparently pointed to a defect in the manner of presenting the additive method. In fact the test papers each month had revealed a weakness which will be pointed out later, this weakness being especially noticeable in the June papers. The scores of the division classes stood as follows; "into" class 20, with a gain of 4; multiplicative class 21.5, with a gain of 2.9.

The last test of the division series had to be given June 17th. At this time the "into" class scored 23, and the multiplicative class 25.5 or 2.5 higher than the former. The preliminary test had placed the initial ability of the multiplicative class 1.8 below the other. Apparently the multiplicative method of division had resulted in a gain of 4.3 over the old way of teaching, and 4.3 is a difference worth taking into account.

One point, however, had not yet been covered in the experiment. The tests had evaluated ability in the separate combinations only. Every teacher of arithmetic is only too familiar with the type of child that knows the separate combinations perfectly, but cannot work longer examples. Would the class taught by the old method in subtraction, the class that could make a score 4.5 higher in table combinations than the new method class, or the new method class in division with a score 4.3 higher than the old, show an equal ability in working the longer examples of the grade? In other words, would ability in separate combinations transfer to longer examples?

To answer this point, a one minute test was devised, consisting of abstract three figure subtraction examples for the subtraction classes, and four figure division examples for the division classes.

The examples were based on the work of the grade, used all the combinations once, and, as far as possible, they were of equal difficulty for the reason given in the other tests. The test was conducted in exactly the same way as the preceding ones. The scoring was on the same basis. The results were as follows: "Take away" subtraction class 15.4; additive class 15.7, showing practically no difference between the two classes in ability to work the longer examples of the grade even when the one point initial difference was considered. The "into" division class scored 18.5; multiplicative class 16, with a difference of 2.5, which in itself is worth consideration, but when reduced to .7 when the initial difference of 1.8 is deducted, is hardly worth taking into account.

CONCLUSIONS

Subtraction Classes

"Take away" class: 4.5 above additive in ability in separate combinations. (1 point difference in initial ability allowed for.)

"Take away" class: .7 above additive in ability in the longer examples.

Division Classes

Multiplicative class: 4.3 above "into" class in ability in combinations. (1.8 point difference in initial ability allowed for.)

"Into" class: .7 above new in ability in the longer examples.

In the case of the subtraction classes, these figures seem to point to a preference for the old method. In spite of the fact that the "take away" class had one hundred new number habits to learn, its final score in the separate combinations, and in the longer examples (initial difference allowed for) was higher than the additive method class. The papers of the children revealed the reason for the apparent failure of the additive method of subtracting. The habit of adding is stronger than that of the other three processes. Courtis recognized this when, in his tests in the four fundamentals, he placed the addition test last. The papers of the additive class showed over and over again a confusion of the two processes, a slipping back into the habit of adding the lower figure to the top one. The "take away" class showed almost no confusion in this. Evidently, if a pupil is to learn to make the reduction called for when the answer is to be smaller

than the top figure, he should learn the reduction as a process apart from special drill in addition. If he is to solve his subtraction examples reliably, he should be taught by some method to keep the two processes distinctly apart.

In the case of the division classes there seems to be a preference for the multiplicative method of teaching division. The reason probably lies in the nature of the two processes, multiplication and division. The child does not have the same tendency to confuse the two as is apparent in addition and subtraction. If he has used either at all outside of school, he has probably used one as much as the other. The very placing of the figures in the written forms suggests different processes. The forms $\begin{array}{r} 8 \\ +2 \end{array}$ and $\begin{array}{r} 8 \\ -2 \end{array}$ suggest little difference, while there could hardly be a confusion as to what to do when the child meets the situations $\begin{array}{r} 4 \\ \times 5 \end{array}$ and $\begin{array}{r} 20 \\ 5 \end{array}$.

He knows in this latter situation that five times twenty is not familiar, and that the real question is, "five times what are twenty?" There is not the same possible confusion, then, in teaching division by the shortened multiplication process as there may be in teaching subtraction by addition. All of this, however, may not be so much a criticism of the method itself as a question of the manner of administering the method.

The final test in longer examples seems to indicate that ability to solve the separate tables has little relation to ability to work the examples, for the additive subtraction class with a low final score in combinations surpassed the "take away" subtraction class in ability to work the examples, while the multiplicative division class, with a high score in combinations fell much below the old method division class in ability to work the examples, all of which raises the question, Is it worth while to teach the separate tables as such at all?


COMPARISON OF THE WORK DONE IN THE SUCCESSIVE MINUTES OF A TEN MINUTE PRACTICE PERIOD IN THE FUNDAMENTALS OF ARITHMETIC¹

FRANK M. PHILLIPS

State University of Iowa

Communicated by Irving King

This investigation was undertaken to determine how far the results of a one minute test in the fundamentals of arithmetic are a fair measure of the pupil's ability in this line and how far the results of a more extended test may be expected to vary from the results of the first minute. This general question resolves itself into the following more specific problems, on each one of which the investigation throws some light: (a) What is the relation of the amount of work done during the first minute, to that accomplished during each succeeding minute of a ten minute practice? (b) How do the results of each minute of practice compare as to variability? (c) What differences appear in the different grades? (d) What is the amount of error for each minute of work, in each grade and in each fundamental? (e) What sex differences appear? (f) To what extent may the ability of a pupil be determined by what he does in a one minute test in the fundamentals or in the first minute of a test covering more time than one minute?

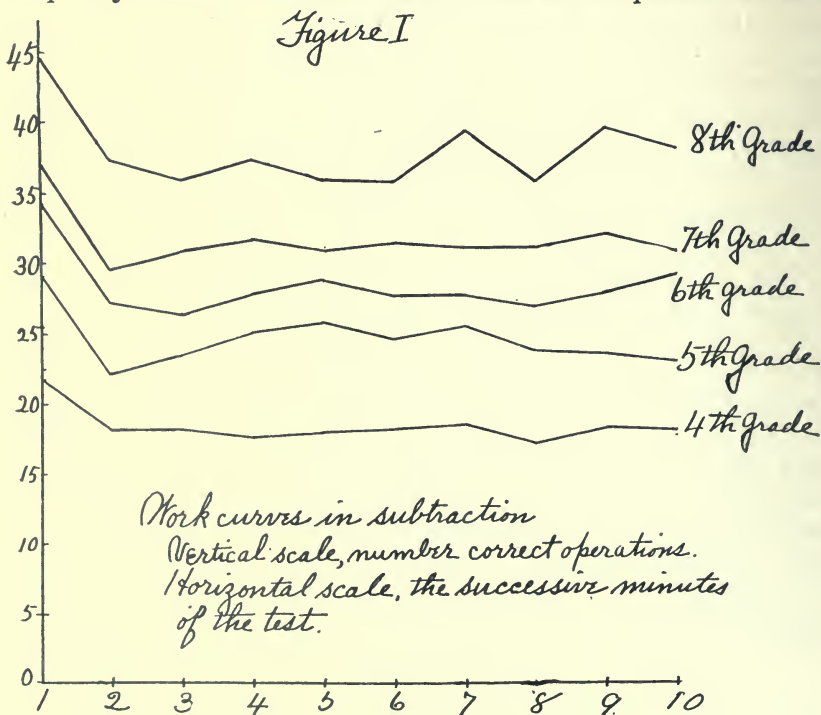
The tests employed were two figure combinations in the four fundamentals of Arithmetic. The combinations were secured by chance drawings of the numbers from 0 to 9. Each practice sheet contained two hundred forty such combinations. In some instances the Courtis "A tests" were used, the arrangement being the same as that stated above. The tests were given in March and April, 1914 and 1915, in representative districts varying in size from a few hundred to ten thousand population. About one hundred pupils in each grade from the fourth to the eighth, inclusive, took part. The sex division was about equal. 

¹An abstract of a thesis submitted to the State University of Iowa for the degree of Master of Arts.

The tests were given as follows: The pupils were supplied with plenty of the test sheets so that no time was lost in the ten minute practice period. They were told to begin at the upper left-hand corner and proceed across the page, one line at a time. They were told that during the test, the conductor would call out "one" and they were to place the figure "1" after their last operation. When "two" was called they were to write a "2" and so on. These numbers were called at the end of each minute until the tenth when they told to stop. They were asked to work as rapidly as possible at all times during the test.

A second test of the same character was given on another day soon after the first one. The results of these two tests were combined into a single set of figures and used as a basis for the computations which follow. Some 8000 test sheets were received, involving 36,820 minute scores and over one million individual operations.

The number of correct operations and the errors were tabulated for each fundamental for each minute of the test. From these, frequency tables were made and medians computed. Tables



were also made to show the average deviations and coefficients of variability for all grades in all the fundamentals.

The median of the work accomplished in subtraction each minute of the practice is shown graphically in Figure I, divided according to grades. The work curves for the other fundamentals showing the variation in median accomplishment for successive minutes are very similar to these here shown. The medians for the first minute are higher than those of the later minutes in practically every case. They range from .21 points to 7.45 points higher than the average of the work of the other minutes, or from 6 per cent. to 21 per cent. higher than the average of all medians for the later minutes of the tests. The lowest point in the work curves occurs in the second minute in eight of the twenty curves. In the remaining curves the lowest point is after the fifth minute.²

The results obtained showed such surprising superiority for the first minute of the tests that the writer decided to extend the inquiry a little further on this particular point. Would the same relation of the first to the later minutes continue to obtain after several more practice periods? Five minute tests in addition and in multiplication were given daily for three weeks to sixty fourth grade and fifth grade pupils. During the latter part of the second week and the early part of the third week the first minute accomplishment was often less than that of the later minutes. The following table gives the median results for each minute of the five as found in the last test.

4th Grade Addition.....	37	31	33	31	31
5th Grade Addition.....	39	35	34	33	35
4th Grade Multiplication.....	26	28	23	24	26
5th Grade Multiplication.....	34	34	32	28	28

The above medians are somewhat higher than those obtained from the first tests. This is due to the practice effect. There is also less difference between the different minute accomplishment than in the first tests. It was also noted that the number of errors did not decrease from day to day.

VARIABILITY. The average deviations are generally a little less in the first minute than in the later parts of the tests. The difference ranges from 0 per cent. to 2 per cent. There is generally an increase in the average deviations as the grades advance.

²Cf. the results here reported with those of Chapman in *A Study of Initial Spurt in the Case of Addition*. This JOURNAL, Vol. VI, p. 419.

The average of all deviations in addition is 7.64, in subtraction it is 7.62, in multiplication 7.16, and in division 7.55.

The coefficients of variability, *i. e.*, the ratios of the average deviations to the medians are from 8 per cent. to 17 per cent. lower in the first minute than in the later minutes. The average of the coefficients of the different grades in addition is .219, in subtraction .271, in multiplication .266, and in division it is .269.

ERRORS. The number of attempts in each fundamental was determined and the number of errors counted. Thus the rate of error was computed for each fundamental, for each grade and for each minute of the tests. The average amount of error in the first minute in addition was .80, in the remaining minutes it was .81. In subtraction it was 1.11 and 1.26 respectively. In multiplication it was 5.32 and 5.49, and in division 2.80 and 2.34. The high rate of error in multiplication was found to be due in part to difficulty with the zero products.

As far as this investigation goes, then, it may be said that from 6 per cent. to 21 per cent. more work is done in the first minute in fundamentals in a ten minute practice than in the average of the other nine minutes and that the product is from 0 per cent. to 2 per cent. less variable, and that it contains from 0 per cent. to 11 per cent. less errors.

SEX DIFFERENCES. The work of the girls averages slightly higher than does the work of the boys. In the eighth grade alone the boys are ahead in all except multiplication and here the girls exceed the boys by only .9 of a point. The following are the average medians for all grades according to sex and fundamental.

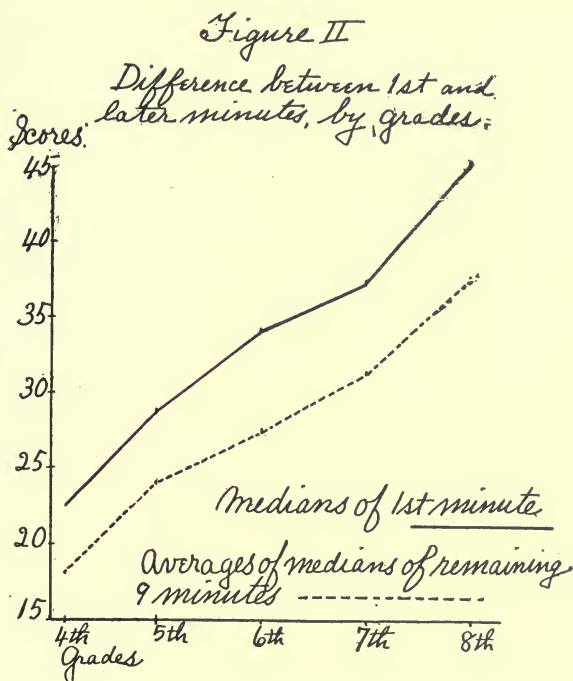
	Add.	Sub.	Mul.	Div.
Boys.....	35	28	28	29
Girls.....	36	28.3	30	31

The girls' entire accomplishment is about 4 per cent. in excess of the boys. A tabulation of the errors by sexes shows that the boys made about 4 per cent. more mistakes than the girls.

The ages which were reported on the test sheets were tabulated by sexes. The fact that the girls average 3.7 per cent. younger than the boys in the same grades is of some interest.

Averages ages of boys and girls by grades.

	4th	5th	6th	7th	8th
Boys.....	10.1	11.0	12.4	12.9	14.2
Girls.....	9.8	10.8	11.6	12.6	13.9



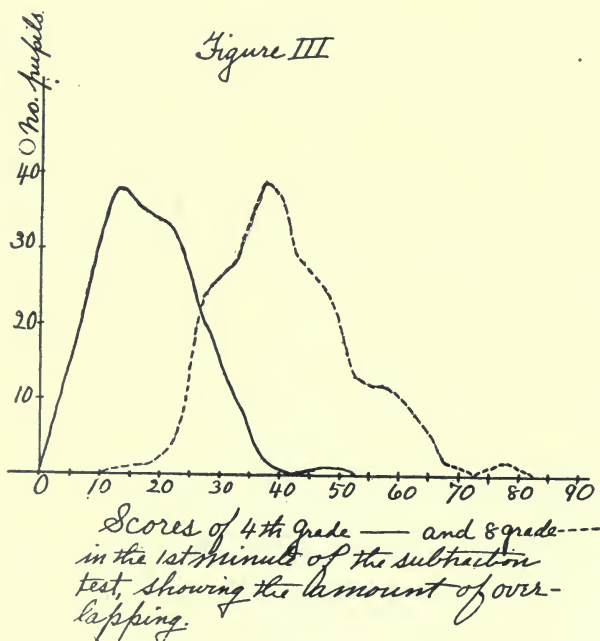
GRADE DIFFERENCES. In the table following are given the medians by grades for the work done in the first minute and for the average of the other nine minutes, in all fundamentals. (1) refers to the first minute and (2) to the combined results of the other nine minutes.

	Addition				
	4th	5th	6th	7th	8th
(1).....	26.7	35.1	40.5	45.8	51.7
(2).....	23.2	30.2	35.6	40.1	46.3
	Subtraction				
(1).....	22.5	28.8	34.1	37	44.6
(2).....	18	24	27.6	31.3	37.3
	Multiplication				
(1).....	19.8	27	31.3	33.6	38.6
(2).....	17.6	24.9	30.9	31.6	36.8
	Division				
(1).....	18.4	26.9	33.8	36.9	42.3
(2).....	14.3	25.2	32	34.5	38.9

Figure II shows this difference graphically for subtraction. It will be seen from the table that there is a considerable difference

between the work of the first minute and the average of all the remaining minutes of the test, but that in the case of the other two fundamentals this difference is much less. It will be seen, also, that the rise from grade to grade is fairly uniform. The 70 percentiles of the grade results compare favorably with the standard set up by Courtis.

OVERLAPPING. Figure III shows the extent of the overlapping of the scores made by the fourth grade with those made by the eighth in the first minute of the subtraction test. In the succeeding minutes the overlapping is about the same for both this and the other fundamentals. There is an average overlapping of 22.4 per cent. of the eighth grade with 23.6 per cent. of the fourth grade for the tests as a whole. This means that about one pupil in four might have been taken from the fourth grade and exchanged for a like number of eighth grade pupils without disturbing the grade differences given above.



CORRELATIONS. The following Pearson co-efficients of correlation were computed between the results of the first minute and the results of the last minute for all the fundamentals.

Grades	4th	5th	6th	7th	8th	Av.
Addition.....	71	46	39	51	60	54
Subtraction.....	57	59	56	67	44	57
Multiplication.....	66	73	72	67	58	68
Division.....	75	73	68	78	66	73

The probable error on account of the large number of cases is very small and it is fair to conclude that a high correlation exists between the work of the initial and final periods of a test in the fundamentals of arithmetic conducted in the manner described in the study.

CONCLUSIONS. 1. From six to twelve per cent. more work is accomplished in the first minute of a ten minute test in the fundamentals of arithmetic, than is accomplished in the average of the later minutes of the test. The high level of the first minute accomplishment is seldom reached in the later minutes. The poorest scores occur most frequently in the second minute.

2. The work of the first minute is less variable than that of the later minutes.

3. There is an almost uniform increase in the median of work done from the fourth to the eighth grade. There is much overlapping of the scores in all grades.

4. Errors are less frequent in the first minutes. The rate of errors is lowest in addition and highest in multiplication.

5. Sex differences are slight. The girls do about 4 per cent. more work than the boys, are about 4 per cent. more accurate and are about five months younger. The boys do better in the eighth grade.

6. Rather high correlations exist between the work of the various minutes.

7. From this study we may fairly conclude that the ability of a pupil in the fundamentals of arithmetic may be determined by what he accomplishes in one minute of work or in the first minute of work. The product of the first minute is a little better than that of the later minutes, a point which should be borne in mind in giving a one minute test.

COMMUNICATIONS AND DISCUSSIONS

MENTALITY TESTS: A SYMPOSIUM.

(Continued from the April number)

It is my belief that it is still premature to attempt to settle upon final scales for age ranges or upon "universal" scales. It is desirable that individuals be encouraged to continue work of this character in all possible ways. But any attempt to force a decision as to the merits of methods of scoring or as to test systems is miscalculated, particularly when the systems involved continue to show correlations of over 90 per cent.

My own interest, as an individual worker, is two fold. First, it is in seeing particular tasks and tests standardized on some graded basis, such as age, school grades or standing, occupational success, etc. (as in Roemer's study of association reactions, Sylvester's study of the form board, and your own tests of musical ability). Related to this is of course the development of graded series of tests of a single, definite, objectively describable process (as in Trabue's scales for language ability, Pintner's work with the Knox cube, Thorndike's reading scales, etc.). When we have a considerable number of such single tasks standardized, and in duplicate or triplicate sets, we may combine them as we like into sectioned or universal scales, correlate them with numerous other characteristics, and, if we dare, classify the separate scales on the basis of the mental functions which they involve.

My second interest is in seeing more work done on the practice limits of numerous tests. Present results indicate that so long as we work with initial trials we are on variable and treacherous ground. Practice limits, however, in even a few tests, seem to be significant not only of actual relative standing but also of general performance. Measures of what an individual *does* do tell us little about the reasons for his achievement, or of what to expect from him ultimately. Measures of what an individual *can* do, however, at least enable us to suspect where his difficulties or his virtues lie.

As distinguished from Professor Yerkes, I am not "eager to see the complete abandoning of all forms of" anything. If there is to be a committee, its work should consist in the encouragement of the continued inquiring use of every possible form of test or scale which anyone has the genius to formulate and the patience to standardize in a preliminary fashion.

H. L. HOLLINGWORTH.

Columbia University.

(1) The problem of intellectual diagnosis seems to present two phases—quantitative and qualitative. I think we have reached the point where we can make quantitative diagnoses. They have a large margin of error and the methods are clumsy. Much of the time, too, we are obliged to take our results on faith before we put them to actual use. That is, we lack objective proof of the correctness of our diagnosis, just as the physician lacks it before he begins his treatment. Despite these imperfections, however, I think we have a right to claim considerable advance in methods of testing *amount of intelligence*. The method involves the use of a large number of tests—just how many is not yet determined—the careful selection of tests with reference to economy, suitability for specific purposes, etc. Methods of treating data and methods of representing scores must also be further refined.

It will be noted that this quantitative measure, even in its finished form tells only how much intelligence is possessed. It is best adapted for the grading of persons in groups. In diagnosing individual cases, however, the qualitative phase is the one that is most insistent. Here the problem is to determine kind of intellectual ability, and in this regard I think we can not lay claim to much achievement. Perhaps the most satisfactory basis on which to attack this problem is that suggested by Professors Yerkes and Seashore, namely, the arrangement of groups of tests “for special functions or groups of functions.” I have nothing to add to their statements on this point.

(2) I have nothing to emphasize regarding the work we are doing here except to remark that we are still at the “quantitative” stage. The work of this third year is being directed toward the more exact determination of the degree of reliability possessed by the series of tests in use. We are examining methods of treating data so as most accurately to represent the measures, and are devising methods that will make for economy in administering the tests. We have now evolved a system whereby we can test 100 subjects with a series of sixteen tests, lasting over two hours, distributed over three test-periods, and work up the results within two weeks.

(3) Regarding steps for the immediate future, I favor above all, the organization of workers into groups, and the policy within each group, of adhering closely to similar methods of procedure. This is absolutely essential to the economical development of tests and the development of norms. For example, all who are interested in the psychological examination of college students should mobilize and

agree upon a number of tests which all will use. Then various problems might be apportioned among these workers. For example, one laboratory might be given the task of trying out several forms of a test for the purpose of determining which form is best; to another might be assigned the task of showing how much weight should be given one test relative to the others in a series, etc. Other groups might well be formed for the standardization of tests in other fields.

HARRY D. KITSON.

University of Chicago.

The following represents my present views and plans on the questions indicated, most of which may be found in greater detail in various articles in the *Journal of Psycho-Asthenics* since 1910.

(1) The Binet-Simon tests offer the best means in existence of determining grades of mental development. Each of the several revisions that have appeared in America is an improvement over the original. None is entirely satisfactory because various improvements are still desirable and possible.

(2) Psychologists should keep in mind more than some are doing at present the distinction between the ideal of maximum scientific accuracy and practical usefulness. The present danger to the future of psychology in this field lies much more in the psychologist's hostile attitude and destructive criticism of the Binet-Simon tests, which are admittedly imperfect, than it does in the errors in mental diagnosis resulting from their use, even when employed by relatively untrained examiners.

(3) Psychologists interested in the work of devising and adapting systems of mental tests should not attempt any without several years of preliminary work in this particular field. An extensive first-hand knowledge of children of all ages is also essential. The history of the Binet-Simon tests themselves has proved this, and stands in danger of repeating itself.

(4) The present chief needs for future progress are (a) a better understanding of the Binet-Simon tests and underlying principles, with a better appreciation of their value and accuracy as they stand, as compared with other methods; and (b) a more ready acceptance on the part of those engaged in test-making of the contributions of co-workers. Progress should be along the line of revision and extension of the old system, following its general plan and underlying principles.

(5) The appointment of a committee to decide on the best form of Binet-Simon tests, or to devise a new system would not be to the best interest of progress. The problem is too large for a committee. It is one on which we can expect constant progress, but never a final solution, any more than we expect the completion of a science. The work of any specially appointed committee would stand in danger of carrying an air of authority and finality beyond its merits, and of discouraging further individual efforts. The existence of several different revisions, or new systems of tests, is not in itself objectionable, or incompatible with accuracy. The field should be kept entirely open, and we should let the test of time decide what shall survive. The present uneasiness, so far as any exists, concerning the value and future of the Binet-Simon tests comes much more from over-ambitious psychologists anxious to offer something better than it does from any failure of the tests themselves in their practical application.

(6) The present status of my own work and plans is as follows: I hope shortly to summarize my results in two volumes, probably under the general title of "Measurement of mental development." One part will be on "General principles." Several chapters of this have been in manuscript form for about a year, when circumstances prevented my completing it. The second part will be a "Manual of tests," comprising essentially a further revision and extension of the Binet-Simon system. I have been engaged for about six years in devising a group of tests that would extend the Binet-Simon system on the upper end so as to include all ages, keeping in mind certain essentials and desiderata that appeared in the daily examination of defective and normal children and adults. Further, the tests and method of scoring in the upper part of the new system will be changed so as to make the scale unlimited in the score that may be attained. Additional tests will also be added to each age-group above two years, increasing the number probably to eight for each age group, and a new group for the age of eighteen months will be inserted.

(7) The arrangement of the Binet-Simon tests in age-groups is convenient, but not an essential part of the system. It would make no material difference to number them consecutively from first to last and express the norms for them in terms of the average total number of tests the children of each age pass, as is done in Yerkes' "Point Scale." Expressing the results in terms of mental ages and "Intelligence quotients" is one of the most valuable contributions yet made and should be adhered to.

(8) The "Point Scale" plan of allowing part credits for different degrees of performance in a test is, I believe, wrong in principle when applied to all tests indiscriminately, and especially for younger children. The best manner of scoring in any case can be determined only by a careful study and analysis of the individual test in question and the mental traits of the age for which it is to be used. The success of many of the Binet-Simon tests is due largely to the fact that several trials are allowed and partial failures not counted. The aim for any test should, in general, be to determine whether the child is capable of performing the kind of task set. One success proves his ability, while failure in one or more trials may only indicate poor effort or other hidden subjective factors peculiar to the individual child, or unknown objective factors peculiar to the trial. The manner of scoring best and necessary for older children and adults may be poorest for younger children.

(9) The general character of the tests, as well as the general mode of procedure in giving them, must differ radically for different ages. I have for several years been teaching the following to my classes: Division into age-periods 0 to 2 yrs.; 3 to 10 or 12 yrs.; and 10 or 12 yrs. to 20 yrs. or more. The inapplicability of tests for the first age-period to later ones is obvious. But I believe that the general readjustments required from the second to the third period are almost as extensive. On the other hand, one continuous system of tests for all ages is desirable and possible. Three independent scales or systems would cause difficulties for the ages near the dividing points between age-periods.

F. KUHLMANN.

Faribault, Minn.

From a study of the significance of mental measurements, arising especially from my attempt to understand the relation of deficiency to delinquency, I have come to the conclusion that the psychologists need a revival. In particular we need to reconsider the principles upon which a scale of mental development should be formulated. I therefore welcome this renewal of the discussion about measurement methods.

As evidence of the confusion in our notions about scales, we may contrast the statements of Cyril Burt and Karl Pearson. Burt is quoted as saying:

"Except for rough and popular purposes, any measurement of mental capacity in terms of age is unsatisfactory. Who would measure height and weight in terms of years?"

To which Pearson replies:

" . . . a year's growth is an absolutely valid and scientific unit, when determined on a big sample, of either head-growth or stature-growth. There is no valid reason to suppose that a year's growth in mental power may not be taken, for all practical purposes, to mean the same unit from ages 6 to 15. . ."¹

This disagreement may have arisen from the faulty and irregular norms for the different ages with the Binet tests. Even if age units were proper during the period of development, it is not easy to find a simple method of stating the change in the conditions at maturity. It is to be noted that the question of age units is independent of the question of arranging the tests in age groups.

The development of a point scale using some tests similar to those of Binet would undoubtedly be an advantage if the tests were weighted empirically. Even when the tests are given different weight in points on the opinion of the investigator, as by Yerkes and Bridges, it is probably some improvement over arbitrarily regarding them all equal, as did Binet. Instead of including some tests which can not be scored for all degrees of accuracy, I should prefer to choose tests, the results with each of which could be scored with continuous units. The problem would then be to build a scale out of such tests. When this is done I believe it will be a great advance over our present scales.

The question whether retardation should be expressed in terms of years, mental quotients, proportion of average scores, or percentile deviations suggests a difficult problem. There is little question but that retardation in terms of years has a definite and important significance to the public. It should probably, therefore, be retained and supplemented by other statistical statements as to the extent of the deviation from the central tendency for the chronological age. On any scale the average score for approximately random groups should be indicated for each age, with the various points of deviation. For *developmental* scales the percentile distribution seems to be best because its significance is more independent of the form of distribution, skewed or normal, so long as one wishes to compare corresponding positions at different ages. It seems to me that this should

¹*Questions of the Day and of the Fray*, 1914, ix, p. 36.

become a fundamental principle in constructing developmental scales. I should, therefore, prefer to express acceleration, retardation, and deficiency in terms of percentiles for the age.

In this connection, why should we not substitute the simpler German term, "life-age" for the cumbersome "chronological age"? Neither custom nor a possibly clearer meaning seems to me sufficient advantage here for holding on to a term which wastes so much time and space, unless that term is very dear to the hearts of my countrymen.

When we have planned a satisfactory scale for general intellectual ability, we should then devote our attention to a conative scale, a scale for emotions, scales to detect special abilities, etc.

Until we have better planned systems of measurement, we shall find, I believe, that developmental scale most useful which has been tried out most thoroughly with the most nearly random groups. The proper interpretation of results is a much more pressing practical problem, it seems to me, than the formulation of more tests or scales on the same lines.

J. B. MINER.

Carnegie Institute of Technology.

My interest in this field has been in the determination of the validity and usefulness of group tests. In the last few years, I have given such tests to many thousand children, and studied the results from many points of view. I am firmly convinced of the usefulness as well as the validity of the tests. A teacher can, by spending two hours in giving the tests and a few evenings in grading the papers, get a knowledge of the abilities of the different pupils that will be of great service to her, not only in the matter of classification and gradation but in the actual teaching of the children. My notion is, that mental diagnosis is of value in connection with *all* the children of the school, and not merely as a means of selecting out the deficient and supernormal. If we are to make this wider use of mental tests, group tests are a necessity, for individual examination of all the pupils is, it seems to me, impossible.

My present views as to the kinds of tests to use, the manner of administering them, and the methods of treating the results are as follows: For all the various important aspects of mental life, we need definite tests. Some of these should test a very simple function; others, a complex of functions. In some cases, the same test

can serve for all ages. In others, we need different tests for different ages. In testing logical memory, for example, I have found it advisable to use one test for the early grades, another for the intermediate grades and still another for the high school. But in the substitution test, one form will serve for all grades. In the new edition of my *Examination of School Children*, soon to be published, I have given up the idea of using the same test for all ages as unnecessary, and in some cases, undesirable.

What type of test shall we use? The answer to this question should come not from a theoretical consideration merely, but chiefly from a consideration of *usefulness*. We should use those tests and that combination of tests which, in practice, give us the best estimate or criterion of what the child can do when the various functions tested work together in actual life. In a very general way we may say these tests are such as determine learning capacity, or the rapidity with which new associations can be built up. Such a test is the substitution test. The new learning apparatus, which I demonstrated at the Chicago meeting, and which has been used in the study of several hundred white and colored children and three hundred adults, gives much promise of usefulness in this field. It enables one to test the ability of a child of any school age to build up sensory-motor coordinations, and does not involve the ability to read or any other school room skill.

After tests of learning capacity come tests of retention, *i. e.*, tests of various aspects of memory, especially of logical memory and rote memory. After tests of ability to get experience and to retain experience, come tests of the usability of experience, such as the association tests, particularly the opposites test. I have found most useful of all, the Ebbinghaus Completion test, which measures a complex of functions. But I shall not attempt here to give a complete inventory of the necessary tests. I very much doubt the practicability of emotion tests; but in the field of motor activity, I have found the tapping test quite worth while. The Binet scheme of a separate set of tests for each age is not what we want, but rather, a systematic series of tests reaching through all ages.

I take it that Yerkes' objection to age norms is to such norms based on the Binet kind of tests. And I think the objection is valid as against that kind of test, but not valid as applied to tests given to successive ages. Let us consider logical memory, for example; we can give a certain test to the primary grades, a different one to

higher grades, and still another to the high school. By equating the value of the different tests, we can establish a continuous scale. And on this scale we can readily place a child with reference to his memory development. These values could be arranged along a scale beginning with zero and proceeding with equal steps. The age and sex norms could be fixed along this scale. The marks of the different kinds of tests could also be equated, so that the same numerical expression would mean the same thing when applied to any test. For example, six in logical memory would mean the same development as six in opposites or learning capacity. And it would be a further advantage if this number corresponded to the chronological age of the child. By this I mean that *six* should be the average mark made by six-year old children; seven, the average mark made by seven-year old children, and so on. It would be very easy to prepare a table for use with the tests, that would enable the examiner at a glance to transfer a child's mark in any particular test to the required scale. For example, in a set of tests, a child might have thirty in logical memory, forty in rote memory and twenty-five in opposites. By reference to a table we might find that these figures corresponded to six, six, and seven, giving an average of six and one-third. Suppose the child is nine years old. We at once see that he is retarded nearly three years. Such a scheme as this would enable us to state the child's ability as determined by adding together the results of all the tests, giving equal weight to the different tests. It also enables us to compare the child's development in different functions.

Since group tests are not applicable below the third grade of school, modifications of the same general types of test should be prepared for use in the first and second grades.

I think we ought to have a national commission acting under the American Psychological Association, to prepare each year a new set of tests and to establish age and sex norms for them. The tests and norms and test material should be ready by September of each year. If the test material and a manual of the tests with directions and norms should be sold at a trifle above cost, the whole scheme would be self-supporting.

W. H. PYLE.

University of Missouri.

(To be concluded in the June number)

SCHOOLS AND CLASSES FOR EXCEPTIONAL CHILDREN¹

This is the title of one of the twenty-five sections of the report of the Educational Survey of Cleveland. It comprises seven chapters as follows: first, Provision for Exceptional Children in Cleveland; second, Why We Have Special Classes; third, The Socially Competent; fourth, The Socially Incompetent; fifth, The Selection of Feeble-Minded Children; sixth, What Should Be Done for the Feeble-Minded; seventh, Summary and Recommendations.

The present discussion will consider only that part of the report which deals with backward and feeble-minded children. This topic occupies three of the six chapters exclusive of the summary, and seventy-one out of the hundred and twenty-two pages. In the summary and recommendations, fifteen out of the thirty paragraphs relate to this subject. They are as follows:

6. "The socially incompetent, upon reaching maturity, should be permanently segregated. Their training should be given in special schools and should be for the purpose of making them partially self-supporting in institutions.

17. "The socially incompetent are those who are incapable of maintaining an independent existence. Among them are the feeble-minded.

18. "The feeble-minded are distinguished from the normal by their inability to meet the complex situations of our competitive social life.

19. "Of Cleveland's school children, over 2,000 are so far behind the majority of children of the same age and social experience that they should be examined by a psychologist to ascertain whether or not they may be trained to live without supervision or assistance.

20. "In some of the classes organized for the mentally slow there is a large proportion of feeble-minded; in others very few. Some of the feeble-minded are still in the regular grades.

21. "For most of these special classes liberal provision has been made, but the results obtained in the attempt to train many of the children do not justify the expenditure.

22. "Children in the classes for defectives are given a physical examination by the physicians of the Division of Medical Inspection. Their home environment is investigated by the school nurses. The

¹ DAVID MITCHELL. *Schools and Classes for Exceptional Children*. Survey Committee of the Cleveland Foundation, Cleveland, Ohio, 1916. Pp. 122.

mental status is determined by the use of the Binet-Simon Tests of Intelligence.

23. "The Binet-Simon Tests, while valuable as part of the mental examination, should not be the sole available ultimate criterion for determining mental status.

24. "The diagnosis of feeble-mindedness should be made by a clinical psychologist who should have the co-operation of the Division of Medical Inspection and the assistance of a trained investigator of environmental conditions.

25. "All children who have failed in two years of school work and are below the fifth grade should be examined by the psychologist. A permanent record of each examination should be kept.

26. "For school purposes the feeble-minded may be divided into three groups. To the children of the two lowest groups no academic work should be given. To the children of the highest group a limited amount of academic instruction may be given.

27. "The teachers of the feeble-minded children need not be highly trained specialists and do not need to receive greater compensation than teachers of the regular grades.

28. "The organization of all classes for the mentally defective should be under the direction of a special supervisor.

29. "The classes for the feeble-minded should be in special schools, since this arrangement allows a proper grading of the children with consequent larger classes and less expense for instruction.

30. "For the segregation of the feeble-minded when they reach maturity, an institution should be provided by the state, or the city, or by both in co-operation."

The recommendations are excellent for the most part and should be read and followed by all school officers, and all those interested in the welfare of our public schools. We question the wisdom of No. 27 so far as it relates to compensation. In the discussion leading up to these conclusions and recommendations the author has, for the most part, made a very clear statement of the situation as it is in general, and undoubtedly in this specified instance in the city of Cleveland. It is interesting to note, for example, that he finds in Cleveland 2,077 children, "approximately 3% of the school population has been in the schools three or more years longer than the grade in which they are would indicate. All of these children may be considered suspects." Experience teaches that when these suspects are carefully examined at least two-thirds of them will be found to

be feeble-minded. This would give the two per cent. which is coming to be accepted as the number of children in any school system who are feeble-minded.

A telling criticism of some of the teaching of defectives is given on page 71, where it is shown that a boy who was being trained on the spelling of the following words, "playground, usual, since, asked, dragged, himself, pretty, many, pale, unlucky, chase, precious, lived, money," could not write from dictation, "It is my bird I see."

It is perhaps unfortunate that the author has let himself be drawn into discussing phases of the problem which involve an intimate knowledge of the feeble-minded, for it is here that he shows a weakness which somewhat mars the value of an otherwise excellent report. This is particularly manifest in his discussion of the Binet Tests. Here the argument is so labored as to savor strongly of prejudice. It would almost seem that he had not been sufficiently sympathetic with the test to read carefully Binet's work, and he makes accordingly several glaring errors. He says, page 74, "In 1905 two French psychologists, Alfred Binet and Theodore Simon, published a series of tests arranged in order of increasing difficulty." Dr. Simon is not a psychologist but a physician. He is assistant physician in the Insane Asylum at Saint-Yon.

Quoting further, "The easiest test of the series should be passed by a three-year old child. For different years of age a different number of tests are provided." The 1905 test consisted of a series of thirty questions arranged in order of difficulty. There was *no attempt to divide them into years* and no statement as to what age the child should be expected to pass the various tests.

"Three years later the tests were revised. This revision was translated into English and the tests were used with American children." The 1908 measuring scale of intelligence was in no sense a revision of the 1905 list of questions, although it used some of the questions which had been suggested in the earlier article. It was a wholly new contribution and was really the first appearance of the "Scale." It is scarcely correct to say that this revision was translated into English since this article (not a revision) comprised 90 pages in the original and only a very brief condensation has ever been translated. Nor did the writer of this review revise that 1908 "revision" as the author of the report implies. Binet himself revised it in 1911, and that revision was the basis of the present writer's English version.

"A child is scored as having the mental development of the highest age for which he has succeeded in all of the tests save *one*." Apparently the author is ignorant of the fact that Binet himself changed this in 1911, making it read, "A child is scored as having the mental development of the highest age for which he has succeeded in *all the tests*." That is the formula that has appeared in all the American editions since 1911.

The author's discussion becomes more and more involved and ambiguous. It is difficult to understand just what idea he wishes to convey. For example, he quotes from Dr. Clara H. Town's translation of the Binet article as follows: "For the method to have a scientific value it is absolutely necessary that the individual who uses it should have served an apprenticeship in a laboratory of pedagogy, or possess a thorough practical knowledge of psychological experimentation." "In spite of this warning these tests have been used in Cleveland and in many other cities as the ultimate criteria for classifying children according to their mental status." This seems to imply that the individual using the Binet test in Cleveland has not served an apprenticeship, nor had practical knowledge of psychological experimentation. If the reviewer is not mistaken this work is done in Cleveland by Miss Charlotte Steinbach. Miss Steinbach has "served an apprenticeship in a laboratory of pedagogy" and is thoroughly competent to give the Binet test, and to decide who is feeble-minded. What may be the situation "in many other cities" does not concern the present survey.

It is unfortunate that the author allows himself to dogmatize as freely as he does, as for example in the following: "Even if the methods of giving the test were perfected to the utmost possible degree, the results would still be unsatisfactory. This is because the Binet-Simon Tests alone do not constitute sufficiently accurate and trustworthy indicators of the intellectual abilities of many children to render them final and reliable guides for pronouncing a child feeble-minded or normal, or a moron or imbecile as the case may be." Such a statement needs to be proved, and the author offers no proof. There are thousands of cases in which the Binet tests alone are ample to decide, not only on the defectiveness of the child, but upon his grade. The author says, "As the tests are administered in Cleveland, the child who is four years retarded, and tests at ten or less, is considered feeble-minded." This is a thoroughly conservative and safe rule. Moreover, the author does not make it clear anywhere that

the Binet tests are the sole criterion for determining feeble-mindedness in the city of Cleveland. In fact he seems to say that only those children, who are suspected because they are behind grade, are referred to the psychologist, and he specifically says that there is an excellent medical examination of the children, and an investigation of their heredity. Presumably all of these facts are available and are taken into account by the Binet examiner.

But it is on page 85 that the author falls into his most serious error. He says, "Two children who do not pass higher than the test for three years are classed as low-grade imbeciles. One of them had lived sixteen years while the other had lived only six. No adequate consideration is given to the importance of the fact that one child is six and tests at three, while the other is sixteen and tests at three." The rest of this page is devoted to a discussion of "the fallacy of such a determination." The author is unfortunately ignorant of the fact, familiar to those who have studied the feeble-minded intimately, that the child who gets three years behind has, *as a rule*, stopped development and seldom progresses appreciably beyond that point. It is true that we do not yet have sufficient data to say that the child who is six and tests three will *never* test more than three. With the child who is sixteen and tests three that will be a certainty. Nevertheless, in the case of the six-year-old child it is a very high probability. In his argument the author assumes that the child is going to develop at a perfectly normal rate, and by the time he is thirty-six years old he will test thirty-three and the differences will be unnoticeable. The absurdity of such an assumption must be evident. The six-year-old child who tests three may possibly at some future time test four, or even five. The chances of his ever being above that are very slight indeed. If he tests four he is still a low-grade imbecile, if he tests five he might be called a middle-grade—a distinction of no very great importance when we remember that if the child is placed in a special class or an institution, he will be given every attention, and any increase in his intelligence will be gladly recognized.

On page 86 the author says: "In Cleveland the methods used for examining children who are suspected of being atypical are usually thorough and comprehensive in those portions preceeding the psychological testing." Now it does not seem from this that the Binet test is the only criterion used. He says: "The schedules in use provide for securing some two hundred and twenty items of informa-

tion, under thirteen heads. All of this work is unusually well done in this city. The one weak link in the chain is the method used in giving the mental tests on which the ultimate decision as to the child's mentality is based."

Again on page 89, the author makes a statement which is very misleading, if not erroneous. He says: "In a similar way the school system should have in its service an examiner competent to employ not only the Binet-Simon tests, but such other tests as, for example, the Yerkes-Bridges Point Scale, the De Sanctis Graded Tests, the Healy Tests, the Terman Puzzle Tests, the Thorndike Mechanical Tests, the Ebbinghaus Completion Tests, the Swift and Terman Interpretation Tests, and the 'Aussage' Tests, as well as tests of physical and motor capacity and those of sensory capacity." Here again, the author's unfamiliarity with feeble-minded persons leads him astray. Most of the tests he names are inapplicable to feeble-minded people, or even to children. The Yerkes-Bridges Point Scale is practically the Binet Test, as nineteen out of the twenty questions used in it are taken directly from the Binet-Simon Scale. Of the rest of the tests above mentioned not one is standardized. It is doubtful if there are six trained psychologists, such as the author likes to insist upon, in the entire United States who could give all of those tests and decide *on the basis of the results* whether or not the child was feeble-minded. In conclusion of this section of his argument the author gives an illustration of what he calls "the type of case which cannot be settled through the application of the tests of a formal and routine nature." He says: "We may cite the examination of a five-year-old child recently conducted at a psychological clinic in another city. *Several psychologists who took part in the examination were doubtful of the diagnosis.** Not one of the examiners was ready to say whether the child was or was not feeble-minded. Several months later the child was brought back for further examination. For three-quarters of an hour the clinician did practically nothing but roll a ball across a table to touch the hand of the child. At the end of that time a slight response was noted. The hands of the child began to move and the ball was returned part way across the table. Shortly afterward the child was picking up the ball and throwing it much as would a normal child. The diagnosis, at the conclusion of the investigation, which included all fields from which

* Italics ours.

additional information could be procured, was 'normal mentality—apparently quite deaf.' A period of training by an expert teacher of the deaf confirmed the diagnosis." It is to be regretted that the author fails to tell us just what this illustrates. Left to himself the writer is compelled to conclude that "several psychologists" took two periods (one of these of three-quarters of an hour in length) separated by several months, to find out that they were dealing with a *deaf child* and not with a feeble-minded one. It is not at all impossible that the Binet specialist might have discovered this fact at the first sitting in a half-hour or less.

The present writer has gone into this matter in some detail, because reports of this character tend to confuse school authorities and encourage their inertia in regard to the defectives in their schools. Whatever opinions one may hold about the Binet scale, it cannot be denied that its advent has done more to rouse the public to the prevalence of feeble-mindedness, and the menace that it is to our social organization, than anything that has ever happened. If the author's point is that the Binet scale does not pick out enough of the defectives, why does he not say so? His implications are that a great many mistakes have probably been made through the use of this instrument. As a matter of fact, there have been picked out of the public schools of Cleveland 1647 feeble-minded children, the great majority of whom would not yet have been discovered, or for some years to come, had it not been for the Binet Scale. Why not say: "This is good, but we want to do better. The Binet Scale left out some who are feeble-minded, we ought to find them also." Upon this we could all agree. It is highly probable that not only those who test ten or under and are four years behind their ages, are feeble-minded, but that a large proportion of those who are only three years behind, perhaps even only two, are also feeble-minded. We need methods of detecting these also, but as yet no method has been devised.

Aside from these few faults, the report is an excellent one.

HENRY H. GODDARD.

Vineland, N. J.

ABSTRACTS AND REVIEWS

RICHARD L. SANDWICK. *How to Study and What to Study*. New York: D. C. Heath & Co., 1915. Pp. 170.

The first part of the book is a simple presentation to "younger students" of a number of "principles of effective study." On the whole this part ought to be of rare value to students about to enter high school or even to those in the eighth grade. However, a few assertions of "principles" seem pernicious. Chapter VI is a blot on the book: "Study aloud or with lips moving, in order (1) to strengthen attention and hold the mind upon the work in hand, and (2) to strengthen the memory by providing more mediums for recall." (Page 41.) This does not accord with the writer's foreword: "As I have kept pace with the slowly developing literature of educational psychology." Modern literature on the higher thought process, on silent reading, etc., even in their slowness have outrun this ardent advocate of studying aloud. In the light of the increase in school study and relative decrease in home work perhaps most pedagogues would prefer not to borrow China's scheme of study.

The second half of the book on *What to Study and How* aims to guide in "a reasonable choice of studies, or strengthen your purpose when a choice has already been made." If the author is taken at his word a majority of high school students may feel obliged to study Latin in order to "increase the power to read and understand English," to spell, and "to appreciate the civilization of the Roman peoples." Some of these students, especially if they get no farther than the high school, may discover that they have chosen a long and rugged road to Rome unless they "trot" with "free translations."

The author maintains that to study history is to induce right personal conduct since good and bad get their due rewards. The "persistent Washington . . . wrings victory from defeat." "The cruel tyrant . . . falls by the avenger's knife." The student that sets out to find these statements true soon would be hopelessly confused by contradictions. History is replete with evidence that the villain does not always get his dues nor the benefactor his reward. Rather, as most texts fail to show, individual conduct of the monarch or the slave earns a reward which is paid to and by succeeding social

generations. The author ignores a still better reason for studying history, namely, to nullify human prejudices and to foster human brotherhood. Designed for adolescents who respond rather readily to appeals for social service, this book unduly emphasizes the bread-and-butter end of learning.

In spite of other obvious defects there are so many good things in this concise, attractive, clearly-written, well-bound little volume that it could be used with profit as a text from which high school pupils could be given some specific directions in the art of study. It should be of special value to the teacher.

GARRY C. MYERS.

Brooklyn Training School for Teachers.

CALVIN N. KENDALL AND GEORGE A. MIRICK. *How to Teach the Fundamental Subjects*. Boston: Houghton Mifflin Co., 1915. Pp. ix, 329. \$1.50.

The term "fundamentals" in education, which originally had reference to the formal subjects only, has come to have less and less significance as some of the older content subjects have gradually found their way into this favored group.

In their discussion in this book, the authors have not only treated as "fundamentals" the formal subjects of English (which includes reading, common speech, composition, grammar, spelling, and penmanship) and mathematics, but to these have added history, geography, and civics, and then, as if to destroy the usefulness of the term "fundamentals" entirely, have devoted one of their best chapters to the subject of teaching hygiene. Not the anatomical, text-book kind of two decades ago, but the kind which leaves the child with such definite ideas and habits as will make a difference in his own health, and in the health of the community. Such an inclusive use of the term "fundamentals" should help in breaking down in school practice, the traditional barrier between the formal on the one hand, and the concrete and useful on the other.

The book is divided into five chapters: The point of view; English; mathematics; geography, history, civics; and hygiene; and no one of the topics has been given an undue amount of space. It is directly addressed to teachers and supervisors, and impresses one as having been written from the standpoint of definite problems, which have been met with in the schoolroom, rather than from the standpoint of the pedagogy of the school subjects. The scientific principles upon

which right method, and the selection and organization of subject matter rest, are liberally drawn upon, but always as explanation or justification for a proposed solution to a problem. The problems of what to teach; when and where to begin it; what shall be its aim; how to present it; what devices are useful in this or that connection; when, how, and for what to test; how to eliminate useless material from the text; how to supplement the text; how to develop a right motive; how to supervise study; how to connect school work with community service; how to make the work concrete; where to find materials for illustrative purposes; how to correlate one subject with others; how to teach a child to reason; when and where to emphasize drill in number work; how to make a lesson assignment; etc., are typical of departure for discussion throughout the book. These are problems with which every teacher is confronted in her daily work, rather than problems of educational theory. Thus the book is itself an excellent illustration of just the sort of procedure it advises teachers to follow. Not only have the authors stated these problems clearly, but they have outlined modes of procedure, to explain which an abundance of excellent illustrative materials have been brought into the book. Thus in explaining the proper use of an arithmetic text, it is not only suggested that children must be taught to draw upon the real reservoir of mathematical problems, which is the life of the school and of the community, but accompanies this explanation with typical problems of the kind suggested.

The book is quite as strong in its discussions of common fallacies in teaching. Not only have such fallacies been selected with a view to show up the false principles involved, thus enabling the teacher to carry the idea over into other teaching situations, but nowhere are we confronted with pages of "don't's."

Such errors as appear in the first problem on page 185, and such inadequate discussion of a difficult task, as teaching how to carry in addition, P. 188, are rare, and of minor consequence. The book is written in clear and simple language, and will be appreciated not only for its sound discussion of practical schoolroom problems, but also for its rich suggestions and illustrations, its abundance of hints as to sources of materials, and for its detailed reading lists.

The book is published as one of the series of Riverside Textbooks in Education, edited by Dr. Cubberley of Stanford University.

J. B. SEARS.

Stanford University.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

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EDITORIALS

We are all familiar with the seductive danger lurking in a show of figures. Figures may not lie, but they may very well lead him who seeks their interpretation into sophistries of which he would be innocent without their inducement. When figures, and particularly averages, are summarized in graphic form, the resulting 'curves' seem to be even more seductive than the figures from which they were derived. There is a story, whether authentic or not, I cannot say, to the effect that when Quetelet first gathered data on the stature of the sexes at various ages, he was irritated because the girls exceeded the boys in height in early puberty, and forthwith corraled sufficiently many short girls and tall boys to correct this 'error' in his curves. There we find an expert who thought he knew beforehand how his curve should run and corrected his observations until they fitted his preconceived notions. In a recent exposition of some of the results of the Cleveland Survey it was shown that in some schools speed in writing mounted fairly smoothly from grade to grade, whereas in other schools, speed in certain grades either showed no augmentation or actually fell off.

It was explained that in these grades unusual effort had been expended upon quality of writing and hence quantity had suffered. That much we may admit; but how can one deduce from these curves the further conclusion that the steadily ascending curve is the *proper* one which all the schools should take as their pattern for improvement in handwriting? Possibly it is, but the curves do not prove it. On the contrary, one might argue, merely as a theoretical hypothesis perhaps, that the best ultimate improvement will result if in certain grades attention is given quite predominantly to improvement in quality and to a sufficient extent to slow the writing during that school year. I do not pretend to possess any expert knowledge upon this particular classroom problem, but I do wish to protest against the process of extracting from curves more recipes for school practice than the data will warrant.

G. M. W.

When Professor Stern's discussion of *The Supernormal Child* appeared in this JOURNAL in 1911, special classes for gifted children were in operation in not more than a half-dozen American cities, and these classes were restricted, so far as I am aware, to the so-called 'preparatory-centers' designed for shortening the work of the 7th, 8th and 9th grades to two years in the cases of selected pupils ranking somewhere in the top quarter or top third of the 6th grade. In the last five years there has been a slow growth of the movement for segregating pupils of superior ability; classes for these children can now be visited in perhaps fifteen or twenty cities. Their development, needless to say, raises numerous problems, administrative as well as pedagogical and psychological, nor have we made even a satisfactory beginning in the solution of many of them. Experience at Cincinnati and at Louisville appears, however, to answer one question of some interest; viz., is it possible and is it desirable to institute special classes for gifted children earlier than the sixth grade? On *a priori* grounds, I believe a good case could be made out for an affirmative answer. In so far as progress through the lower grades is mainly dependent on facility in acquiring the various 'tools' of study, with relatively less need or possibility of supplementing routine classroom work by various 'excursions' into accessory materials, it would seem probable that the shortening of the time expended by extra-competent pupils would here be not only free from objection,

but positively desirable. That this theoretical assumption is substantiated in practice is sufficiently evident from observation of the work of the special fourth-grade class at Louisville, Kentucky. Here the best four or five per cent. of the previous third-grade pupils in several buildings are assembled in single a group and complete the fourth-grade work in one-half the school year without the slightest difficulty. Their subsequent progress in the grades is all that could be expected. It is not without interest to note that Petzoldt, the German authority in this field, defines a gifted child as one who, without detriment to his health, can accomplish two years' work in one. His prediction that 10 per cent. of German pupils could exhibit this grade of efficiency suggests that probably even more pupils could be drafted into special classes than has been attempted at Louisville.

G. M. W.

NOTES AND NEWS

To what extent may field work be profitably carried on in higher education? The medical school has for years had its post-graduate connection with the hospital which provides field work for the young intern; normal schools and departments of education require practical work of their students as pupil teachers; co-operative courses in engineering have been developed, with part time in college and part time in real, commercial work; and now departments of economics, sociology, and government are devising ways of giving their students practical instruction through field work in official bureaus, social settlements, and city departments. Some educational authorities who favor laboratory instruction within college walls do not consider it wise to devote part of a student's time to outside field work. They hold that the innovation is not a mere extension of the laboratory principle, but an entirely new principle. The advocates of field work are divided on the question of what constitutes field work, some holding that the field work of others is mere inspection and observation, not true work at all. No considerable group has agreed upon a standard definition or scale of credits toward graduation. The Association of Urban Universities has appointed a committee of nine prominent educators to make an extensive investigation and report on the value of field work, the wisdom of recognizing it with college credit, the methods of conducting it, the selection of students, organization of their work, correlation with formalized instruction, and the branches in which it may be used to advantage. The chairman of the committee is President Parke R. Kolbe, Municipal University of Akron, Ohio, and the committee will welcome reports and other information from persons and institutions interested in the general problem.

The Committee on American Speech, of the National Council of Teachers of English, calls attention to the April issue of the *Journal of Ophthalmology, Otology and Laryngology*, of Cincinnati, which is devoted to a symposium on speech, voice, and hygiene of the vocal tract by representatives of professional and commercial circles. There are articles by leading physicians, public school executives, by Otis Skinner for the actors, and by representatives of the Chicago Telephone Co., Marshall Field and Company, etc. It is a broad

survey of these subjects from the point of view not of the professional teacher of speech, but of the public. It should prove of interest alike to the schools and to the general reader.

Under the directorship of Dr. Charles S. Berry, of the University of Michigan, special courses will be given for teachers of backward and mentally defective children at the Michigan State Normal College, Ypsilanti, during the summer session. They will include courses in mental deficiency, psychological testing, methods of teaching backward and defective children, speech defects, etc.

Dr. Nathan Oppenheim, the author of several books and numerous articles on the development, the hygiene, and the diseases of the growing child, died in New York City, on April 5, aged fifty-one years.—*Science*.

Dr. Milo B. Hillegas, associate professor of elementary education in Teachers College, Columbia University, has been appointed commissioner of education for the State of Vermont, and will assume the duties of his position about July 1.—*School and Society*.

Dr. Lewis M. Terman, associate professor of education in Stanford University, has been promoted to the rank of full professor in that institution.

Dr. H. L. Hollingworth has been advanced from assistant professor to associate professor of psychology in Columbia University.

Dr. Robert Morris Ogden, professor of psychology at the University of Kansas, has been appointed professor of education at Cornell University.

Dr. W. S. Foster, instructor in psychology at Cornell, has been made assistant professor of educational psychology.

Dr. Frederick G. Bonser, associate professor of industrial education in Teachers College, Columbia University, has been promoted to a full professorship of education and given charge of the courses concerned with the elementary school curriculum. Special attention will be given to the needs of supervisors of vocational and rural schools.—*School and Society*.

CURRENT PERIODICALS

SCHOOL AND SOCIETY. Vol. II, No. 49, December 4, 1915. IRVING KING. *An Inquiry into Certain Aspects of the Study Habits of University Students*. 824-828. A questionnaire was carefully prepared to bring out the student's understanding of the assignment, the length of time spent in preparation, a chronological account of the different things done in preparation, a statement as to whether this was the usual preparation, and an indication of the presence or absence of a definite study program. This questionnaire was answered by students from 56 classes in 1914 and 19 classes in 1915. The results are shown in the form of graphs and tables. There was no correlation between ability and time spent on the single lesson in question.

No. 50, December 11, 1915. L. W. SACKETT. *Measuring a School System by the Buckingham Spelling Scale*. 860-864, 894-898. The scale values were worked out for five of the Buckingham lists, the words were thrown into sentences and these sentences dictated to each class of two school systems. The ranking of each half grade in each of twenty-four schools is indicated and graphs show the distribution of pupils for school grades three to seven, in these schools. Girls showed superiority over the boys in all grades varying from .3 to 3.9 scale units.

No. 52, December 25, 1915. KATE ANTHONY, MARY L. MCGAHEY, AND EDWARD K. STRONG, JR. *The Development of Proper Attitudes Towards School Work*. 926-934. A test of the results of special coaching in arithmetic for four months. Four cases are reported in detail with clinical case studies, records of improvement with standard tests and an analysis of the difficulties encountered. An excellent example of the use of objective tests in educational diagnosis and treatment.

Vol. III, No. 53, January 1, 1916. FREDERICK J. MANN. *Eye Strain and Retardation in School Life*. 33-36. The literature of myopia in connection with the schools is a very extensive one, but the present careful study of 191 eye cases shows that hyperopia is five times as prevalent as myopia, and is a much more serious cause of eye strain and of retardation in school. All truants and school laggards should be carefully studied for hyperopia.

No. 54, January 8, 1916. ROBERT COMIN. *Teachers' Estimates of the Ability of Pupils*. 67-70. A series of twenty-three arithmetic problems was arranged in order of difficulty by twenty teachers, and each teacher made an estimate of the per cent. of the class that would solve each problem in ten minutes. The problems were then given to fifteen hundred pupils in the fifth, sixth, seventh, and eighth grades, and their ranking in real difficulty was determined. The coefficient of correlation between this ranking and the combined teachers'

estimates was .74. The author concludes that the judgment of any individual teacher is likely to be erratic, but the judgment of the group is fairly accurate. The estimates of the percentage of pupils that could solve each problem in ten minutes showed much greater variation than the ranking of the problems.

No. 55, January 15, 1916. H. Y. BENEDICT. *Grades and Their Standardization at the University of Texas*. 105-107. A comparison of the grades given to freshmen and to upper classmen for the last five years. On the basis of this tabulation the university faculty has adopted a standard distribution of grades for all classes that have more than ten members.

No. 56, January 22, 1916. THOMAS R. GARTH. *A Statistical Study of the Contents of Newspapers*. 140-144. The daily issues of twenty-seven representative newspapers were examined to determine how many column-inches were devoted to each of thirty-three topics so selected as to include practically all of the solid reading matter found in the papers examined. From this the percentage of the total space was computed and the amount of variability determined. A consideration of the different percentages and of the fluctuation of different topics is interesting.

No. 58, February 5, 1916. J. E. WALLACE WALLIN. *A Census of Speech Defectives Among Public School Pupils*. 213-216. The article reports the results of a census of speech defectives among 89,057 public school pupils of St. Louis, in which the data were gathered through a questionnaire sent to the principals of all the schools. The total number of speech defectives was 2,536, or 2.8 per cent. of the total enrollment. The article presents the relative frequency of the different speech defects, their relation to sex and to left-handedness. The total number of stutterers was 683, or .7 per cent. The boys show a striking preponderance in all types of speech defect, but the results fail to establish any connection between speech defect and the coercion of left handed children to write with their right hands.

No. 61, February 26, 1916. JOHN T. McMANIS. *Individual Differences in The Early Grades*. 289-295. The author gives due credit to the flexibility of the course of study in the high school and the upper elementary grades, but deplors the rigidity and formalism of the work in the lower grades. It is particularly in the grades below the sixth that the taste for study or dislike for it is established and that the fundamental habits of thought are fixed. The exodus from the schools in the sixth, seventh, and eighth grades is due primarily to improper training and the arousal of a hostile attitude toward school work in the lower grades. The author pleads for a more careful study of individual differences in those grades and a better adaptation of school work to individual needs.

ABRAM LIPSKY. *School Guidance by Mental Tests*. 320-324. The author tested 247 boys with an association test involving the pairing

of Italian-English words. A number of these boys were also tested with several of the Woodworth-Wells association tests. The Pearson coefficient of correlation between Italian-English association and examination marks in German was .53.

No. 62, March 4, 1916. C. J. ANDERSON. *Is the Exemption System Worth While?* 357-360. The author finds the exemption system deleterious in its effect upon the rigor of teachers' gradings, and in its effect upon the quantity and quality of the work done by the pupils.

THE SCHOOL REVIEW. Vol. XXIII, No. 10, December, 1915. H. V. CHURCH. *An Experiment in Cooperation in English.* 670-678. All the teachers in the high school were enlisted to train the pupils in three aspects of work in English; first, subject spelling. Lists of words difficult to spell were made out for each subject, and a small portion of the recitation time in that subject was devoted to the spelling of these words. Second, meanings of words. Special lists of words were constructed for their relationships of meaning, and pupils were asked to invent sentences to indicate that they knew the meanings. Third, recitation English. Certain rules were formulated for the guidance of each teacher in order to secure the best possible English expression from the students. There are four charts showing the grades in special subjects and the English grade of the pupils computed by the teacher in each special subject.

DANIEL STARCH. *Some Experimental Data on the Value of Studying Foreign Languages.* 697-703. At the University of Wisconsin the scholastic records of students who enter with Latin are less than one per cent. higher than those of students entering with German. The English vocabulary of those who had studied Latin was 2.7 per cent larger than the vocabulary of those who had not studied Latin. The study of foreign languages materially increases a student's knowledge of English grammar, but only slightly increases his ability to use English correctly.

Vol. XXIV, No. 1, January, 1916. H. O. RUGG. *The Experimental Determination of Standards in First Year Algebra*, 37-66. As an outcome of the work of a committee of the mathematics section of the Illinois High School Conference an attempt was made to work out a scale for algebra problems, both mechanical and applied, whereby the results of one-year's high school algebra might be measured. The article presents a general classification of the subject matter of first year algebra, and a discussion of the fundamental criteria for the design of an algebra scale. The test series adopted contained eight specific tests of twenty-five problems each and twenty-five general or applied problems. These tests were given to 518 pupils, and the results were scored for the number attempted and the number right. The paper presents tables of the number and types of errors and the psychological principles underlying these types. The

author concludes that inefficiency in algebraic solution is due primarily to lack of mastery (habitualization) of a few typical operations which recur frequently in such solution.

No. 3, March, 1916. H. D. KITSON. *Psychological Tests and Vocational Guidance*. 207-214. The author believes that if we really to guide young people in their choice of a vocation the individual should be measured from every standpoint—physiological, psychological, sociological, and economic. Each of these views of the individual is only partial and all must be taken in order to ascertain the true relation. The author surveys the work of Dr. Woolley at the Vocational Bureau in Cincinnati, of Dr. Weidensall in New York City, and of Dr. Walter Dill Scott of Northwestern University. He objects to the pigeon hole method of placing the pupil for his future vocation, and urges the adoption of the *monitory* conception of the function of guidance bureaus.

JOURNAL OF EXPERIMENTAL PSYCHOLOGY. Vol. 1, No. 1, February, 1916. HERBERT WOODROW. *Outline as a Condition of Attention*. 23-29. In this paper the author compares the effect of definiteness of outline upon sustained attention by the objective method of reaction time with the results obtained from subjective introspection. By both methods it is found that an illuminated area of a given intensity has a greater effect upon attention when it has a definitely outlined form.

GRACE HELEN KENT. *A Graded Series of Geometrical Puzzles*. 40-50. It has been pointed out that the Binet tests of intelligence are predominately verbal, and it is desirable to supplement these by tests into which the verbal element does not enter. The author has devised a series of twenty-four puzzles consisting of rectangular or triangular pieces of wood. Each puzzle when solved forms a square and the task is to fit the pieces into a frame ten centimeters square. A table presents the results of using these puzzles with twenty-five individuals ranging from six to seventy-five years of age. The test is an interesting one and is worthy of a more systematic and extended experimental use.

THOMAS H. HAINES. *Relative Values of Point Scale and Year-Scale Measurements of One Thousand Minor Delinquents*. 51-82. The author presents a brief sketch of the development of the Yerkes point scale and shows the inadequacy of the Binet tests of intelligence. Extended tables and graphs give a comparison of the point-scale and year-scale scores of 671 delinquent boys and 329 delinquent girls. By the Binet scale fifty-six per cent. of the delinquents are pronounced feeble-minded, a finding which the author stigmatizes as grossly misleading. The point scale results show that delinquents yield considerably lower averages than children in the public schools. About twenty-five per cent. of the delinquents are twenty-five per cent. below the normal standard,—thus reducing the Binet estimate of feeble-mindedness by more than half. The author finds the point scale a much more delicate measuring instrument than the Binet scale and advocates its use in mental measurements.

PUBLICATIONS RECEIVED

RICHARD BAERWALD. *Zur Psychologie der Vorstellungstypen, mit Besonderer Berücksichtigung der Motorischen und Musikalischen Anlage.* Leipzig: Verlag von Johann Ambrosius Barth, 1916. Pp. x, 444. M.14.

This study of the psychology of imagery types, with especial reference to motor and musical capacities, is founded on a questionnaire circulated under the auspices of the Berlin Psychological Association. The questionnaire differed somewhat from the usual investigations of that type, in that it suggested a number of specific experiments to be performed and called for systematic introspection on them. The author devotes twenty-five pages to a critical evaluation of this type of investigation, describes in detail the sources of his material and the reasons for selecting the classes of people studied, and surveys the possible imagery types and the reasons for the unsatisfactory outcome of previous experimental investigations. Part Two brings an extended analysis of motor-mindedness, including inner speech, writing and drawing imagery, kinaesthetic reproduction, and the relation of motor tendencies to other aspects of consciousness. Part Three deals with the psychology of musical people, and Part Four discusses the antagonism between the various fields of sensory reproduction. Whether one accepts or rejects the doctrine of imagery types one will find much interesting data in this volume.

FRANK W. BALLOU. *Geography. A Report on a Preliminary Attempt to Measure some Educational Results.* Boston: Bulletin No. 5 of the Department of Educational Investigation and Measurement, 1916. Pp. 38.

The author devised two sets of geography questions, one on the United States, the other on Europe, and gave them to 594 pupils of the upper elementary grades, the high school, and the normal school. The results for each question are discussed in detail, and the distribution of pupils is shown by tables and graphs.

H. A. BROWN. *The Measurement of Ability to Read.* Concord, N. H.: Bureau of Research of the Department of Public Instruction. Bulletin No. 1, 1916. Pp. 55.

A single reading selection was used in all grades above the second to measure ability in silent reading. In scoring the results the selection is divided into forty sections each of which represents a unit of thought. The reading time allowed was one minute and the method of test was reproduction. The monograph contains blanks for reading, frequencies for rate of reading, comprehension, and reading efficiency, and graphic representations showing the results attained in each grade.

ELIZABETH COOPER. *The Harim and the Purdah. Studies of Oriental Women.* New York: The Century Company, 1916. Pp. 309. \$3.00.

The author presents an intimate and authoritative account of the status of women in Egypt, Arabia, India, China, and Japan. Many of the fantastic ideas that are generally prevalent regarding Eastern women are here shown to be pure fiction. It is true that the status of woman in these countries is bad enough from the western point of view, but since most Eastern women know no other mode of life they not only acquiesce in their condition but regard with shrinking alarm any proposal to change it. There will have to be a tremendous amount of education of both women and men before Eastern women can play a very important part in social life, and whatever changes may take place will come about as a result of the efforts of the men rather than of the women.

JOHN M. COULTER. *Evolution, Heredity, and Eugenics.* School Science Series, Number Five. Bloomington, Illinois: John G. Coulter, Publisher, 1916. Pp. 133. 50 cents.

This little volume is designed to supplement elementary biological texts and to furnish in brief and simple form a serviceable idea of modern conceptions of evolution and of their significance in human life. There is a discussion of the meaning of evolution, a brief history of the theories of evolution, the fundamental features of natural selection, the theory of mutation, the problems and machinery of heredity, the evolution of plants, the beginnings of animal life, the appearance of air-breathers and vertebrates, the evolution of various organs, and the elements of eugenics. There is great need for a simple manual of this type, and it is to be hoped that in the near future such a course of study will be required of every high school pupil.

STANLEY DE BRATH. *Mysteries of Life. A Book for Boys and Girls.* New York: Chas. Scribner's Sons, 1916. Pp. xvii, 260.

The author of this book is a former head master of an English preparatory school, and his purpose in writing it seems to be to interpret the facts of modern science from a religious point of view for the spiritual uplift of the youth. Part One, entitled "What?" contains two chapters, one on the mystery of the body and another on the mystery of the heavens. Both body and heaven are treated as manifestations of a divine intelligence or creative power. Part Two, entitled "How?" deals with the history of the earth and with human evolution. The author's point of view is summed up in the statement "Every species arose from variations, due to Creative Mind acting in matter." Part Three entitled "Why?" discusses the mystery of sex, the history of pain, the revelation of God, and the mystery of the kingdom of heaven. The book contains much moralizing on the war.

CHARLES W. ELIOT. *Changes Needed in American Secondary Education*. New York: General Education Board, Occasional Papers, No. 2, 1916. Pp. 29.

The author contends that the training of the senses should be the prime object in human education from primary to professional school. An examination of the programs of American secondary schools shows that little attention is paid to this most vital part of education. There is a strong plea for more hand, eye, and ear work, such as drawing, carpentry, turning, music, sewing, and cooking, and the giving of much more time to the sciences of observation, as chemistry, physics, biology, and geography. These sciences are to be taught in the most concrete manner possible. In an appendix many instances are cited to show how insignificant is the time devoted to these observational subjects compared with that given to linguistic, literary, mathematical, and historical subjects.

MARION ERWIN. *The Universe and the Atom*. New York: D. Van Nostrand Company, 1916. Pp. 314. \$2.00.

"The object of the present work is to furnish an explanation of the physical universe and the atom on simple mechanical principles." The author has endeavored to make the treatment convincing and intelligible to the lay reader as well as to the advanced scientist, and to do this he has explained the main features of wave action in connection with the physical phenomena upon which the wave theory of light rests. The author's conclusion is "that in the universe matter is being created by radiations from other matter all the time; that there is going on all the time the gathering up of this unborn matter by gravitation into clusters and suns; that in time these suns go to a kinetic death and finally the matter of which they are composed is converted again into ether substance, thus we have an endless cycle of births, lives, deaths, and resurrections in the material universe."

ABRAHAM FLEXNER AND FRANK P. BACHMAN. *Public Education in Maryland*. A Report to the Maryland Education Survey Commission. New York: The General Education Board, 1916. P. 176.

"In the following pages an effort is made to describe the organization of public education in Maryland, to estimate its efficiency, and to suggest such changes as appear at once desirable and feasible. It is hoped that legislation supplementing and improving the present state system may result, but even should this be the case, public education will continue to disappoint unless higher ideals result from completely divorcing education from politics." Among the topics considered are the state board of education, the state superintendent, the county superintendent, the teachers, attendance, instruction, and financial readjustments.

H. L. GANTT. *Industrial Leadership*. New Haven: Yale University Press, 1916. Pp. xii, 128. \$1.00.

How far should the state go with industrial and vocational training? The author contends that the state should give a broad, general training, and that the industries themselves should furnish that more specialized training which individual industries demand. In addition to the chapter which gives the title to the book, there are chapters on training workmen, on the principles and the results of task work, and on production and sales. There are several elaborate graphs and charts in color.

ELIZABETH HARRISON. *When Children Err. A Book for Young Mothers*. Chicago: The National Kindergarten College, 1916. Pp. 177.

This little book deals with that most important of all topics, the establishment of standards of conduct in the mind of the child. The standards are the resultants of two forces, impulses from within and disciplinary treatment from without. The book contains an abundance of anecdotes in illustration of the points made, and a good discussion of different types of punishment.

SHATTUCK O. HARTWELL. *Overcrowded Schools and the Platoon Plan*. Cleveland: The Cleveland Education Survey, 1916. Pp. 77. 25 cents.

The author first describes the Gary plan, shows its excellencies and defects, and advocates the platoon plan as superior. According to this plan, the children are divided into two groups, made up of equal numbers of classes. While one group is engaged in regular school work, the second group is doing special work in special classrooms, in auditorium, gymnasium, etc. At the middle of the morning session the two groups change places. A similar shift is made in the middle of the afternoon. There is a detailed consideration of what the adoption of the platoon plan in Cleveland would involve and of the advantages to be gained. The plan it would seem might be adopted in any large school system.

W. H. HECK. *Health of School Children—II*. Bulletin, 1915, No. 50. Washington: Bureau of Education, Pp. 187.

This is a summary of contributions to the subject of the health of school children appearing in American medical journals from July, 1914 to July, 1915. It will be a great convenience to school hygienists to have brought together the widely scattered articles that bear upon the health of the school child. One finds reports of improvement in the medical inspection of schools, in the control and prevention of infectious diseases, in the measures taken to curb such scourges as infantile paralysis, pellagra, and trachoma, the treatment of tuberculosis, disturbances of the mouth and throat, eye and ear defects,

correction of faulty posture, nervous and mental disturbances, and the supply of food and air.

DAVID S. HILL AND MARY L. RAILEY. *Educational Research in Public Schools*. Annual Report to the Superintendent of Schools, New Orleans: Division of Educational Research, 1915. Pp. 211.

Part One of this report deals with comparative measurements of the progress in school of 36,000 children in New Orleans. There are age grade tables for both white and colored schools, and the data are further presented in the form of graphs. Part Two presents a practical study of the elimination of pupils from school, recounting an attempt to ascertain the actual amount of elimination, to discover by personal visits the causes operative in elimination, and to show the types of pupils who leave the grammar grades. The data are tabulated by months and presented in both tabular and graphic form. Part Three is a study of the ideals of children and the occupational preferences of 7,000 pupils thirteen years of age and older. Part Four presents further studies of individual variation, and Part Five is a note on the Delgado Survey of Industries. This valuable investigation shows what excellent scientific work may be done in school systems when encouragement is given by school authorities.

GEORGE E. JOHNSON. *Education Through Recreation*. Cleveland: Cleveland Foundation Survey, 1916. Pp. 94. 25 cents.

The surveyor reports that Cleveland is extraordinarily well-equipped in recreation plants and in teaching force. He recommends better organization of recess periods, more out-of-door recreation, more free play in the lower grades, organized games in the elementary school, a director of social recreation, a director of plays and games, and a director of the play of young children. The book contains many photographs of recreation activities in Cleveland and many diagrams showing the relative number of those engaging in the various forms of recreation.

CHARLES HUBBARD JUDD. *Measuring the Work of the Public Schools*. Cleveland: Cleveland Foundation Survey, 1915. Pp. 290. 50 cents.

This report involves a scientific study of handwriting, spelling, arithmetic, and reading in schools, and the observation of the instruction in kindergartens, elementary schools and high schools. In handwriting a large number of specimens were collected in grades five to eight which were scored for both rate and quality. The latter scoring was made on the basis of the Ayres Scale. An interesting graph shows the average speed of handwriting and each quality from 20 to 90 for the grades mentioned. All grades showed a steady decrease in speed with increase in quality. In the spelling tests lists of twenty words each were made up from the Ayres Scale and given as isolated words and in sentences. In spite of the claims that have

been made for the teaching of spelling in Cleveland the tests show that the city has only an average rank in this subject. In arithmetic tests were devised in the fundamental operations, somewhat similar to the Courtis tests but more varied and more inclusive. Tests were given in both oral and silent reading, and the comprehension of the pupil was checked by reproduction. The book contains valuable material on educational measurements.

GRACE HELEN KENT. *A Graded Series of Geometrical Puzzles*. Reprinted from the Journal of Experimental Psychology, Vol. 1, No. 1, Feb. 1916. Pp. 40-50.

The author presents a series of twenty-four puzzles consisting of rectangular or triangular pieces of wood so constructed that when the pieces are put together they form a square. This fits into a wooden frame, ten centimeters square, and the puzzles thus partake of the nature of a form-board exercise. Twenty-five subjects were tested, ranging in age from six to seventy-five. The puzzles made of triangles were found to be much more difficult than those made of rectangles. The correlation between skill in solving these puzzles and general intelligence has still to be worked out.

DARWIN OLIVER LYON. *The Relation of Quickness of Learning to Retentiveness*. Archives of Psychology, No. 34, Jan. 1916, 60 pp. 50 cents.

The writer used groups of twenty nonsense syllables according to three different methods. Supplementing these are digits, words, prose and poetry. The subjects were normal college seniors, and members of a university class in experimental psychology. Groups of high school students, grammar school students, asylum attendants, clerks, and business men were used for check purposes. The conclusions emphasize the extreme complexity of the memory process, the high correlation between general intelligence and memory, the difficulty of determining the relation of quickness of learning to retentiveness, and the superiority of girls to boys in learning but not in retentiveness. The first member of a series is always retained longer than the middle members.

DAVID MITCHELL. *Schools and Classes for Exceptional Children*. Cleveland: Cleveland Foundation Survey, 1916. Pp. 122. 25 cents.

The book contains an account of the provisions for exceptional children in Cleveland, the reasons for dividing exceptional children into two groups, the socially competent and socially incompetent, a discussion of the principal types in each group, the role of the Binet tests in the diagnosis of feeble-mindedness, and provisions for the care of the feeble-minded. The author takes a stand against the employment of highly paid teachers for the feeble-minded, since less

skillful, less highly trained, and less expensive teachers attain just as satisfactory results.

WALTER S. MONROE. *A Report of the Use of the Courtis Standard Research Tests in Arithmetic in Twenty-four Cities*. Emporia: Kansas State Normal School, Vol. 4, No. 8, 1916. Pp. 94.

Chapter One contains a description of the tests (Series B), directions for giving, marking and tabulating the tests, and fifty-one tables presenting the results in detail. Chapter Two contains a discussion of standards with suggested modifications of the Courtis standards; Chapter Three an interpretation of city distributions; and Chapter Four the use of individual scores. This is an important contribution to measurements of arithmetical abilities.

JOHN J. B. MORGAN. *The Overcoming of Distraction and Other Resistances*. Archives of Psychology, No. 35, February, 1916, Pp. 84. 75 cents.

When we are thinking, trying to solve some mathematical or practical problem, or reading a book, we like to have it quiet. Is this merely a habit, or is it a real factor in concentration of attention? The problem in this investigation was to discover the way in which a person will react to irrelevant noises which are produced while he is engaged at some task. By an escapement device a series of varied stimuli were presented, to which the subject was required to react in different ways as quickly as possible. The responses were made on ten reaction keys, electrically connected with a recording apparatus. Breathing and pressure records were also taken. Fifteen different types of noise were used as distractions. The initial effect of noise is to retard the speed of work. After this initial retardation there is an increase in speed. Extra effort is put forth to overcome the noise. Articulation is frequently used as a means of overcoming the effect of the noise and of focusing the attention to the work in hand. The changes in the amount of energy expended were much more significant than changes in the time of reaction.

EDITH E. READ MUMFORD. *The Dawn of Religion in the Mind of the Child. A Study of Child Life*. New York: Longmans, Green and Company, 1915. Pp. xi, 111. 50 cents.

This booklet contains many anecdotes and some moralizing but little psychology. It would be very interesting and valuable to have an authentic, first-hand study of the development in the child of ideas about religion. Such ideas would be necessarily imitative and would reflect the religious observances and conversations of those about him. It would be worth while, however, to have an accurate and painstaking account of the way in which this is done. It is to be regretted that the present book contributes so little to that end.

WILLIAM BENNETT MUNRO. *Principles and Methods of Municipal Administration*. New York: The Macmillan Company, 1915. Pp. xvi, 491. \$2.25.

The aim of this book is to show how various city departments are organized, what work they have to do, and what problems they usually encounter in getting things done. Among the departments considered are streets, water-supply, waste disposal and sewerage, lighting, police, fire, school, and finance. In school administration, the author notes the tendency toward the reduction of the size of school boards, and the election of members at large or appointment by the mayor or court. The prevailing length of term is from four to six years. The functions of the school board are summarized, and the superintendent's duties are discussed under the heads of selection of teachers, arranging the program of study, and discipline and promotions. There are also sections on municipal school management, the school house and its equipment, centralized control of city schools, school finance, and new demands upon the schools. The imperative need in school administration is a more complete record and a better classification of data.

GEORGE NASMYTH. *Social Progress and the Darwinian Theory. A Study of Force as a Factor in Human Relations*. New York: G. P. Putnam's Sons, 1916. Pp. xxiii, 417. \$1.50.

"This book has to do with one or two of the really fundamental questions which concern men condemned to live together in society. . . . The vast and co-operative partnerships of human association do not work toward efficiency by one of the parties exercising compulsion or coercion upon the other, but by free co-operation based upon an intelligent recognition of mutual interests in such co-operation." The author believes that the Darwinian view of social relationships has been grossly misunderstood and misinterpreted, and has written this book to show that the doctrine of force, of might, of power, which the German theorists have proclaimed as the guiding principle of the state from the point of view of evolutionary sociology, is in entire contravention of Darwin's fundamental social idea. Not force but justice and mutual aid must be the watchwords of social progress. The book is largely a sociological study of the phenomena of the present war, and takes its starting point from the writings of Novikov and other Russian sociologists.

F. H. NEWELL AND C. E. DRAYER. *Engineering as a Career*. New York: D. Van Nostrand Company, 1916. Pp. xii, 214. \$1.00.

This is a collection of papers contributed by eminent engineers on the various activities involved in engineering and the qualities necessary for success. There are papers on mechanical, railway, hydraulic, metallurgical, electrical, chemical, marine, sanitary, bridge, architectural, and mining engineering, and a brief discussion of vocational guidance. The papers are all of the decidedly popular type, and the

book might well be used for supplementary reading in the high school in connection with vocational guidance work.

IRIS PROUTY O'LEARY. *Department Store Occupations*. Cleveland: The Cleveland Foundation Survey, 1916. Pp. 127. 25 cents.

This study of department store conditions will be of interest to other communities besides Cleveland, and will be suggestive to school authorities and vocational guidance bureaus for a similar survey of their own localities. The study includes not only department stores, strictly speaking, but also neighborhood stores, and five and ten cent stores. There is an analysis of jobs and a consideration of the vocational training for department store workers.

GEORGE HENRY PAYNE. *The Child in Human Progress*. New York: G. P. Putnam's Sons, 1916. Pp. xix, 400. \$2.50.

This is a novel and enlightening book on the child. The author has painstakingly hunted out from the records of anthropology and early history, and pieced together to make a complete picture for us, the ideas and customs of primitive and early peoples with reference to children. There is a sketch of the development of parental care with illustrations from the higher animals; the restriction of the number of children among primitive tribes; Chinese, Japanese, and East Indian treatment of children; the sacrifice of the first-born in South America and Western Asia; family life in Greece and Rome; the attitude of the early Christians toward children; and the crimes against children in the 19th and 20th centuries. The narrative is almost revolting in its cruelty and bloodthirstiness, and one marvels that the human race has been able to survive its own attempts at self-destruction. It is to be hoped that this sombre picture of the diabolical treatment of children in the past will help to make the 20th century the real century of the child.

FREDERICK E. PIERCE. *Selections from the Symbolical Poems of William Blake*. New Haven: Yale University Press, 1915. Pp. xiv, 79. \$2.00.

In this introduction to Blake's poems the author has endeavored to make such a selection as would lead by graduated steps from the simpler and more obvious to the more abstruse and esoteric products of his muse. In so doing he has rendered a distinct service to all who desire to become acquainted with this fantastic genius. Even with such help no little expenditure of effort is necessary to master the involved and exclamatory style.

WALTER REEVE RAMSEY. *Infancy and Childhood. A Popular Book on the Care of Children*. New York: E. P. Dutton and Company, 1916. Pp. xx, 198. \$1.25.

The author well says that the old time mysticism which still to some extent surrounds medicine must disappear and the public be:

taught what it may rightfully expect of itself and the physician. He then proceeds to give in the simplest possible words the approved conclusions of medical science on growth and development, the care of the new-born, breast and artificial feeding, teething, diet, exercise, contagious diseases, and various other questions about which it is important for mothers to know.

Report of the Committee on Elimination of Subject Matter. Iowa State Teachers' Association, 1916. Pp. 54.

This report presents abundant evidence that school men are realizing the necessity of omitting many topics that have been taught in the past, and of concentrating attention upon those topics which are of distinct significance in social life. The subjects considered are arithmetic, grammar, writing, geography, physiology, history, and spelling. The discussion of each subject is based upon the results of recent experimental studies.

J. B. SEARS. *Spelling Efficiency in the Oakland Schools.* Oakland, Cal.: Board of Education Bulletin, No. 9, Nov., 1915. Pp. 79. 25 cents.

The Ayres spelling lists, as used in the Springfield survey, were given to forty elementary schools of the Oakland system, embracing 12,982 children. Each child first filled out a blank showing his age, grade, father's occupation and nationality, language spoken in the home, and the occupation the child would like to follow. A blank was also filled out by the teacher showing the time spent on spelling, methods of teaching, assignments, and study of books and articles on spelling. The average for the city, grades III to VIII, was 77.4 which is 7.4 higher than the Ayres standard. Tables and graphs show the standing by schools and grades, the distribution by grades and classes, age-grade distribution and spelling efficiency, spelling ability by age groups, sex and spelling efficiency, general ability in school work and spelling ability, and distribution of spelling ability by home language, father's nationality, father's occupation, and the child's ambition. Chapter five discusses the administration and teaching of spelling from the point of view of results shown by the tests. The correlation between time allotment and spelling ability seems to be slightly negative. This is the most detailed and elaborate investigation of the spelling of an entire school system that has yet been published.

J. W. SLAUGHTER. *The Adolescent.* New York: The Macmillan Company, 1915. Pp. xv, 100. 60 cents.

This little book is dedicated to G. Stanley Hall and is based upon his two volume work on *Adolescence*. The author intends this little book as a sort of introduction to Dr. Hall's work, but assumes complete responsibility for the interpretation of the facts. There are chapters

on growth, development of instincts and emotions, skepticism, unification, juvenile crime, and the education of boys and girls during adolescence.

J. RUSSELL SMITH. *Commerce and Industry*. New York: Henry Holt and Company, 1916. Pp. viii, 596.

This book deals with explanations rather than mere facts and statistics. Man's activities are its central theme and the reasons for these activities give rise to the problems treated. How does climate affect man? How does the soil feed him and furnish materials for shelter, heat, power, and industry? How does the form, location, and surface features of the land affect his efforts at trade? The first three hundred pages are devoted to typical industries of the United States. The industries of the remainder of the world are briefly considered in two hundred pages, and the last fifty pages deal with world commerce. This is a stimulating and practical kind of study which should be much more extensively pursued in our high schools than it is at the present time.

BERTHA M. STEVENS. *Boys and Girls in Commercial Work*. Cleveland: The Cleveland Foundation Survey, 1915. Pp. 181. 25 cents.

This book includes a study of commercial work in the retail store, the wholesale business, manufacturing, banking, civil service, and the small office. On the basis of this data recommendations are made for the commercial training of boys and girls.

MARION REX TRABUE. *Completion-Test Language Scales*. Teachers College Contributions to Education, No. 77. New York: Teachers College, Columbia University, 1916. Pp. ix, 118. \$1.50.

This monograph presents the latest development of the Ebbinghaus completion-test into a series of scales of equal or increasing difficulty. Each of these scales has been carefully standardized and the steps are arranged at approximately equal intervals. We have here therefore a delicate and precise instrument for measuring the abilities of pupils in this type of linguistic work. The mathematics involved in deriving the scales and in determining the intervals between the steps are presented in detail.

HOWARD C. WARREN. *A Study of Purpose*. Reprinted from the Journal of Philosophy, Psychology, and Scientific Methods, Vol. 13, No. 1, 2, and 3, January and February, 1916. Pp. 72.

The author finds that the distinctive feature of the purposive experience is the inversion of the usual time order of certain events. The five factors of this consciousness are forethought, assent, potency feeling, the self-notion, and the sense of fitness. Anticipation and fitness are genuine biological phenomena and seem to be limited to living organisms; otherwise, there is no evidence of purpose in nature.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

TESTS FOR ORIGINALITY¹

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GENERAL PLAN OF THE EXPERIMENT

The purpose of the investigation was (1) to adapt and devise tests for originality, and (2) to determine by trial the relative value of these tests as a means of ranking the members of a group in terms of originality. The selected tests were applied to 100 students drawn from all classes in Northwestern University and also to one inventor of international reputation.

After preliminary experimentation with a variety of tests, the following twelve were selected and modified for subsequent use: (1) Word-Building; (2) Picture Writing; (3) Analogues; (4) Original Analogues; (5) the Chain Puzzle; (6) the Triangle Puzzle; (7) Royce's Ring; (8) the Completion Test; (9) Economic Prophecies; (10) the Code Test; (11) the Invention for Sheet Music; and (12) Novel Situations. Of these, Picture Writing, Original Analogues, Economic Prophecies, the Invention for Sheet Music, and Novel Situations were devised in the Psychological Laboratory of Northwestern University; the remainder were adaptations or modifications of tests previously used elsewhere.

A time-keeping device, which made it possible for the subjects to record their own time, was constructed. The "minute hand" was a series of cards numbered from 0 to 10. These were sus-

¹ This article represents in a condensed form the material submitted by the author as a master's thesis at Northwestern University in 1914. Credit for general arrangement and oversight of the work should be given to Professor W. D. Scott, under whom the investigation was conducted.

pended on a rod, and removed one by one at intervals of sixty seconds. The "second hand" was a placard upon which had been pasted numerals from 1 to 60, inclusive. Each succeeding second was indicated with a pointer by the experimenter.

There follows a description of the twelve tests.

1. WORD-BUILDING

The test followed the directions given in Whipple's *Manual of Mental and Physical Tests*, 2d edition, page 641, save that the time was reduced from five to three minutes, that only the *AEOMBT*-form was used and that *A* and *O* were not counted as words. The instructions to the subjects were first given orally with illustrations, then given again by means of a large placard on which they were displayed.

2. PICTURE-WRITING

For this test five specially prepared cards were used. The first card was shown with this explanation: "These characters are picture writing and have actually been used by a people to express the meaning written after them. The third word is made up of the elements contained in the other two." After this first card had been explained, the four remaining cards were exhibited for a period of two minutes each. A score of 1 was credited for each card correctly solved.

The actual characters used were Chinese: in the following description of the cards the original symbols are replaced, for convenience in reproduction, by Roman letters. The original cards showed clearly that the third character represented in each case a combination of the first and second character.

Sample card
A means *country*
B means *people*
AB means *democracy*

Card 3
E means *to take*
F means *woman*
EF means what ? (verb)

Card 5
I means *to quiet*
J means *heart*
IJ means what ? (verb)

Card 2
C means *enclosure*
D means *man*
CD means what ? (noun)

Card 4
G means *sun*
H means *horizon*
G means what ? (noun)

H

3. ANALOGUES

This test was suggested by the analogies test used by Wyatt. The material, however, was entirely new. Papers on which were the following analogues were distributed face downward:

Illustrations:

1. a hoe : a gardener :: scissors : (a tailor).
2. a county : (a state) :: a room : a house.
3. a ring : the finger :: (a bracelet) : the arm.

In the following, supply in the brackets the word needed to complete the relationship:

1. a cat : a mouse :: a hawk : ().
2. a consistent worker : a spasmodic worker :: () : a geyser.
3. an automobile : () :: a safety match : flint.
4. a common pen : a fountain pen :: odd jobs : ().
5. a caterpillar changes to a cocoon, then changes to (), as ice changes to (), then changes to steam.
6. $ab : bc :: democracy : ()$.

N. B.² a is the picture writing for people.

b is the picture writing for king.

c is the picture writing for enclosure or country.

ab is the picture writing for democracy.

Before the subjects looked at the papers the experimenter explained that analogues were "word-ratios," and illustrated this statement by placing several upon the blackboard. Those who completed the test within the allotted eight minutes were instructed to record their time.

The scoring was complicated because of errors, omissions, and lack of uniformity in time. The final score was calculated by adding to the time recorded by the subject, a fine of one-sixth of this time, plus an additional minute for each error or omission save that in the fifth analogue, in which two terms were to be supplied, each error or omission counted one-half the usual fine.

4. ORIGINAL ANALOGUES

The instructions for this test were first given orally, then shown on a placard, which read:

Make two original analogues.

Record the time.

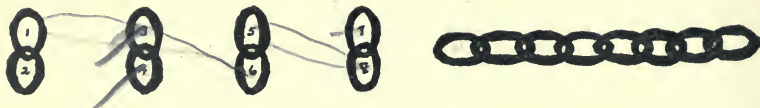
In scoring the recorded time was (1) decreased one-fourth for excellent quality, increased one-half for poor, and left unaltered for good; and (2) decreased one-sixth for each analogue given beyond the required two, and increased one-half for failure to

² Here the letters a , b , and c have been substituted for the Chinese symbols actually used.

give more than one. This arbitrary evaluation of quantity seemed justified because of the probability that less time is required to write a second or a third analogue than to write the first.

5. THE CHAIN PUZZLE

The instructions for this test were as follows: "A farmer had four pairs of links which he wished to have united into a continuous chain. Each cut was to cost ten cents and each weld ten cents. Show how this could be accomplished at a total cost of forty cents." Links of paper were prepared so that there could be no misunderstanding as to the relation of the various links to one another. They were then drawn and numbered as in the accompanying illustration.



On the placard of instructions was written:

Each cut — 10c.
 Each weld — 10c.
 Total cost — 40c.
 It can be done.

Ten minutes was allowed for the solution of the problem. The time recorded by the students determined their score.

6. THE TRIANGLE PUZZLE

These instructions were presented on a placard:

"Out of six toothpicks make four equilateral triangles, each side of which shall be as long as a toothpick. It can be done. Record the time."

In order that the solution might depend upon constructive thinking alone, as was explained, no actual materials were supplied. The time-limit was ten minutes. The score was the time required.

7. ROYCE'S RING

Royce's ring is made from a narrow strip of paper, the ends of which are pasted together after a twist of 180 degrees. A red line marked the longitudinal center of either side of our ring.

The experimenter explained the construction of the figure by preparing a similar ring before the class. The experiment was

then conducted in three distinct parts. The first direction was as follows: "Describe fully the figure which would result if the ring were cut along the central line, including in your answer these three points: (1) the number of rings; (2) their interconnection; (3) the number of degrees of twist." After the descriptions had been written, the ring was cut. The resulting figure, a ring with a twist of 720 degrees, was then shown to the class and very carefully explained. The second direction was to describe the figure which would result if the ring were again cut. Then, when the ring had been cut and the resulting figure, two interlocked rings, each with a twist of 720 degrees, had been explained, the last direction, to describe the figure which would result if the rings should be similarly cut, was given. Again the rings were cut as previously, producing four rings each with a twist of 720 degrees.

In the grading of the first part, a score of 9 was given for a correct solution, a score of 6 for the answer: "one ring twisted 360 degrees." Because of the decreasing difficulty of the problem, a score of 6 was given for the correct solution of the second part and one of 3 for the third. Less value was given to partially correct answers. The final score was the total of these gradings.

8. THE COMPLETION TEST

Completion Test No. 1 (Whipple's *Manual*, p. 652) used with the instructions:

"Supply all missing words or letters. Try first of all to 'make sense'; second, to fill in every omission; third, to work as rapidly as possible. The length of each dotted line shows approximately the length of the word or portion of a word to be supplied."

The time-limit was 7 minutes in scoring, each omission filled correctly was given full credit; each one filled partially correctly, one-half credit. The score was the total credits.

9. ECONOMIC PROPHECIES

The experimenter spoke preliminarily to this effect: "Five hundred years ago the automobile, the air-ship, and the steam railroad were entirely unknown means of locomotion. If any one then had said that today we should be traveling by these means, his statement would have been an economic prophecy. At that time, also, the present methods of heating by furnace

and steam radiators were unheard of. Advertising was an undeveloped science. Skyscrapers had not yet been constructed. You are now to be asked to make some economic prophecies." The subjects were then directed to suggest as many entirely original means as possible of (1) locomotion, (2) heating, (3) introducing the product to the consumer, (4) housing for people. These topics were announced by four placards and two minutes were allowed for each one. The suggestions were graded on a scale from 0 to 5 in proportion to their originality. The final score was the total of these gradings.

10. THE CODE TEST

The civil war code described by Healy and Fernald¹ made the basis of this test.

The placard upon which the code was written was displayed for fifteen seconds to give the subjects an idea as to its nature. To illustrate its use the experimenter then showed a second placard on which was written the word *celery* and its code translation. The code placard was again displayed, in juxtaposition with the second placard, while the experimenter indicated from what portion of the code the symbols were taken. Then the subjects were told that the code would again be shown for a period of sixty seconds, after which they would be given (1) a message to translate into the code language, and (2) one in the code language to read. These two messages were printed upon placards thus: (1) Come quickly. (2) (in the symbol of the code) "Foe near at hand; beware!" The subjects recorded their own time. The time-limits were three minutes first, and three and a half minutes for the second message.

In scoring, since there were eleven letters in the first message, a fine of one-eleventh of the allotted time was imposed for each error or omission; similarly for the second message, of one-nineteenth. Disregard of a dot was fined one-half the usual amount. The final score was the sum of the time recorded in each portion, plus the fine.

¹ W. HEALY AND GRACE FERNALD. *Tests for Practical Mental Classification*. Psychol. Monog. March, 1911, Whole No. 54, pp. 33f.

11. THE INVENTION FOR SHEET MUSIC

For this test the following instructions were displayed on a placard

"Numbering each, suggest as many details as possible for an invention to turn the pages of sheet music."

In judging the papers, the experimenter first placed in one group those suggesting inventions which would actually turn several pages of sheet music; in a second, those suggesting a means for turning one page; in a third, those suggesting less complete devices; and so on. She then arranged the papers within the groups in order of merit. The final score was determined by the rank-order of the subjects.

12. NOVEL SITUATIONS

The following questions were handed, face downward, to the subjects:

1. If some inexpensive metal should be discovered which, when put in cables, could transmit light at slight cost, what results would follow?
2. If trusts should get control of the surface of all oceans, what competition could arise which would offer means of transportation?
3. If all water, because of some change in its chemical constitution, should contract instead of expand upon freezing, what would be the effect upon animal life, including man?
4. If the prophecies that the earth is going to cool down should come true, what could man do to keep from becoming extinct for a time at least?
5. If the possession of money or wealth in any form should come to be regarded as dishonorable, what significant changes would result?
6. If, because of the exhaustion of materials from which paper is made, its manufacture should absolutely cease, what substitutions could be made?

The instructions were as follows: "Please read and answer only the first question at this time. You will be given two minutes and thirty seconds for this. Stop writing when the experimenter calls time; then pass to the second one; and so on, until the entire six have been answered."

The method of scoring was similar to that employed in Economic Prophecies, i. e., the final score was the sum of the gradings.

THE RESULTS

In this article it has been necessary to omit the original scores. On the basis of these scores there was calculated the rank-order of the 100 students in each test, and also his final group rank,

which was determined by the median of his several ranks (unless the medians were tied, in which case the averages were used).

In the summary tables that follow these abbreviations are used: W. B., Word-Building; P. W., Picture-Writing; Ana., Analogues; O. A., Original Analogues; Cha., the Chain Puzzle; Tri., the Triangle Puzzle; Roy., Royce's Ring; Com., the Completion Test; E. P., Economic Prophecies; Code, the Code Test; I. M., the Invention for Sheet Music; N. S., Novel Situations.

1. RANGE OF PERFORMANCE

A general idea of the performances of the students in the several tests may be gained from Table 1, in which is shown the best, the median and the poorest score in each test. The symbol *F* in the third line means "failed to accomplish the test within the time-limit set."

TABLE 1
Limiting and Median Scores

Test	W.B.	P.W.	Ana.	O.A.	Cha.	Tri.	Roy.	Com.	E.P.	Code	I.M.	N.S.
Best....	23	4	104"	37"	50"	50"	15	99	60	162"	1	76
Median..												
Worst..	7	0	760"	405"	F	F	0	12	0	F	96	8

2. CORRELATIONS

In Table 2 there are shown the correlations existing between the rank-order of the 100 subjects in the several tests and their amalgamated rank-order for all the tests combined. These correlations, which were computed by the Spearman "foot-rule" method with *R* converted into *r*,⁴ indicate the relative degree to which the outcome of each test agrees with the general outcome of all the tests. The probable error of *r* for 100 cases may be taken as approximately 0.04.

TABLE 2
Correlations between the Several Tests and the Final Rank-Order

W.B.	P.W.	Ana.	O.A.	Cha.	Tri.	Roy.	Com.	E.P.	Code	I.M.	N.S.
.25	.40	.57	.54	.54	.54	.41	.44	.55	.26	.52	.56

3. RELIABILITY OF THE SINGLE TESTS

In Table 3, an indication of its reliability is given for each test by adding the per cent. of subjects among the first twenty-five

⁴ For the method see WHIPPLE, *Manual of Mental and Physical Tests*, 2d edition, pages 43-44, Formulas 33 and 35.

of the group of one hundred whose rank in the test under consideration is greater than that of the median rank of the last subject in the group, 37 +, and the per cent. of subjects among the last twenty-five whose rank is less than the median rank of the first subject in the group, 60.5. This method shows, then, the per cent. of subjects in the first and the last quarter of the group who would have been thrown out of their respective divisions had but the one test been used in ranking them.

TABLE 3

Reliability

W.B.	P.W.	Ana.	O.A.	Cha.	Tri.	Roy.	Com.	E.P.	Code	I.M.	N.S.
39	84	29	28	20	74	46	30	32	42	25	36

4. RANK OF EACH TEST AS A PROBABLE MEASURE OF ORIGINALITY

Table 4 gives the ranking of the tests upon the basis (1) of their correlation with the final group rank, (2) of the per cent. of subjects among the first and the last twenty-five who would have been thrown out of their respective groups had but the test under consideration been used in ranking them, and (3) of the sum of (1) and (2).

W.B.	P.W.	Ana.	C.A.	Cha.	Tri.	Roy.	Com.	E.P.	Code	I.M.	N.S.
12	10	1	4	5	6	9	8	3	11	7	2
8	12	4	3	1	11	10	5	6	9	2	7
10.5	12	1	3	2	8	9	7	5	10.5	5	5

The correlation, obtained by the Pearson method adapted to rank-differences is .50.

COMMENT ON THE TESTS

The tabulated results alone are not sufficient basis for evaluating the tests because of inadequacies in the method of giving the test or in the system of scoring. Supplementary observations may, therefore, assist in reaching a fairer judgment.

Word-Building has the lowest correlation with the amalgamated rank-order. This is probably due to the fact that about one-half of the subjects had played anagrams, as was ascertained by means of a questionnaire, and these subjects consequently had some advantage over other members of the group. The test would doubtless have been fairer, therefore, had a fore-exercise been given. The rank correlation between word-building and the completion test, the one seemingly most closely related to it, is only .28, which is less than would have been

anticipated except for the interference of this factor.* Terman found the use of a rational plan an important element in the procedure of those subjects who succeeded best in these tests. Whipple used word-building to test imagination and invention, but did not report the finding of any significant correlations.

Picture Writing gives promise of becoming a very valuable test if a few slight changes in the method are made, since its correlation with the final group rank is considerably higher than might be expected from the large number of "ties,"—a factor tending to reduce correlation. Since but one subject in the first group failed to determine the correct word to be supplied, as compared with eight subjects in the fourth group, it is clear that the test differentiates the good group and that the addition of more cards would yield still better results. Probably the length of time allowed for each card could be shortened, also, since many of the subjects did not require the full two minutes.

Analogues ranks first among the tests. It might have been even more valuable, however, if the "picture writing" analogue (No. 6), which was by far the most difficult, had been replaced by one more nearly like the others, or if the time required for the solution of the five similar analogues and that for the solution of the sixth had been separately recorded. Wyatt found that his analogies test gave a very high correlation with subjective estimations of intelligence, as did also the completion test.

Original Analogues is likewise very successful.

The Chain Puzzle can be modified so as to become a very effective test. Since but five subjects of those ranking among the first twenty-five of the group, nine among the second, twenty among the third, and twenty among the fourth, failed to solve it; and since thirty-one of the forty subjects who succeeded in solving the puzzle are within the first half, it is evident that this test differentiates the good subjects quite successfully. Indeed, of all tests, this best determines the first and the last groups of twenty-five. The fact that the correlation with the final group rank is relatively high, notwithstanding the large number of ties, is another proof of its value. A greater differentiation and

* Wyatt has reported raw correlations of .36 and .70, and a corrected correlation of .97, between these two tests.—*Editor*.

possibly a still higher correlation would be secured if the time allowed for solution were increased to fifteen minutes.

Similar observations may be made regarding the *Triangle Puzzle*. Of the fourteen subjects who gave a correct solution within the ten minutes allowed for the test, ten were ranked among the first twenty-five of the group, three among the second, none among the third, and one among the fourth. Since so few subjects succeeded in solving the problem, it is evident that the allotted time was entirely too short; even twenty minutes might with profit have been allowed for the solution. Our results support the conclusions of Lindley and of Terman that puzzles are valuable test material.

Since no one answered the entire test correctly, it is apparent that *Royce's Ring* presents an unusually difficult problem—a conclusion further confirmed by the results of Royce and Johnson and Gregg. The value of the test, especially of the last two parts, is questionable, because most of the students were so surprised at the outcome of the first cutting that their subsequent answers were mere guesses.

The efficiency of the *Completion Test* would in all probability be increased if a fore-exercise were given, as has been suggested in the case of Word-Building, since some of the subjects did not pause to read the instructions carefully.

Economic Prophecies is among the most reliable tests of the twelve from the standpoint of the extent of correlation with the final group rank. Its low correlation with the Chain Puzzle, .24, is not surprising in view of the large number of ties in the latter test.

The *Code Test* seemed to be much enjoyed by many subjects, but the results do not indicate that it is of especial merit in testing originality, although it necessitates, as Healy states, close attention and steadiness of purpose.

The *Invention for Sheet Music* ranks second in its differentiation of the entire group in respect to the first and the last twenty-five subjects. Some of the inventions suggested were exceptionally well planned and seemed to be entirely practicable.

Novel Situations is second in extent of correlation with the final group rank. Since the mental activities required in response to the tests are similar to those involved in *Economic Prophecies* and the *Invention for Sheet Music*, it is interesting

to note that the three tie in average merit and are among the most effective tests. This result is gratifying, since they were among those devised in our laboratory.

It is evident that the tests, because of their varied nature, could not possess equal value as tests for originality, yet all would appear to test some phase of this trait.

Inspection of the original scores reveals the fact that if three very typical tests, namely, Analogues, the Chain Puzzle, and Economic Prophecies, had been employed, only three subjects would have been thrown out of the group of the first twenty-five, and only four out of the group of the fourth, twenty-five in the amalgamated rank-order. It is thus evident that the employment of these tests alone would have differentiated the group in a manner similar to that accomplished by the use of all the tests.

Finally, it is interesting to note that the inventor did not give exceptional evidence of originality in his response to the tests, though he ranked within the first half of the group. While it would have been most gratifying if his record had been high in every instance, for two reasons his showing in the tests does not invalidate their claim to be tests for originality. In the first place, his age may have prevented his making an unusual record; he was a man past middle life, while the students were all, with a possible exception, under thirty. In the second place, it may very well be that innately he is not unusually original, that his success in invention has come partly as a result of circumstance, and partly as a result of persistence and exhaustiveness of method. He says: "I do not know that I am particularly original; needs have accidentally been brought to my attention, and I have sought to meet them." He made no important invention until his twenty-eighth year, when his attention was called to the need for a practicable time stamp, which he very shortly devised; another success some time later encouraged him to devote much of his time to invention. Thus, accident appears to have been influential in stimulating his inventiveness, while industry and perseverance have contributed to his success.

A TENTATIVE STANDARDIZATION OF A COMPLETION TEST

WALTER R. MILES AND JULIAN E. BUTTERWORTH

The study supervised and the report edited by Professor Irving King, University of Iowa

The aim of the following study was to determine as far as possible the relative difficulty of the various elisions of one of the widely used completion tests, "Where the Dandelions Went." It will often be desirable to have such an evaluation of the separate blanks, if the test is used for anything but the roughest of measures. If a time limit is set for the test which will not permit of its being finished there must be some method of scoring what is done in terms of the difficulty of the various parts. The correction of errors also requires a definitely determined series of weights for the various elisions or blanks.

This particular test was selected, not as being superior to others, but simply to illustrate a method of evaluating which may be applied to any test of this character.

Hitherto, most of the users of such completion tests have tended to assume, in practice, at least, that each blank space is of equal value with every other blank. Ebbinghaus, for instance allowed 1.0 for each elision properly filled and for each failure to fill an elision .5 was deducted. He also deducted 1.0 whenever an elision was improperly filled. Terman and Childs who used a similar completion test (The Strength of the Eagle) in their "*Tentative Revision and Extension of the Binet-Simon Measuring Scale of Intelligence*"¹ recognized on the other hand that all parts of the selection are not of equal difficulty. They therefore modified it by printing all the blanks of equal length, thus giving no suggestion of the length of the word or part of word to be supplied, and further, they divided the selection into approximately four equal parts, the first part mutilated to the extent of 33 1-3%; the second, 45%; the third, 54%; and the fourth, 66 2-3%. In scoring, each elision, if correctly supplied, was given a credit of 6, 8, 10, or 13, accordingly as it occurred in parts I, II, III, or IV of the test.

The present investigators felt that the difficulty of any particular portion of this test is not so much dependent upon the

¹ JOURNAL OF EDUCATIONAL PSYCHOLOGY, Vol. III, p. 198ff.

degree in which words are omitted as upon the nature of the omissions. For instance, elided verbs are less easily supplied than elided adjectives or adverbs.

The reader may here raise the objection that it is scarcely worth while to evaluate accurately every omission in a completion test; that it should be sufficient to rate a set of papers according to the fractional part of the whole performed. If the test is expected to yield only a very rough measure, such a procedure would undoubtedly do well enough. But the results of the test have seldom been interpreted as merely rough measures. Usually the investigator attempts to assign to each paper a definite numerical grade. If, however, the omissions are not of equal difficulty it would seem that comparisons or correlations based on grades determined on the basis of the equal difficulty of all elisions, should be open to serious question.

Whether it is worth while or not to attempt the careful evaluation of a completion test, such as is here proposed, this study will show at least two things: First, that it is possible to assign fairly accurate values to the different blanks of such a test, and second, that a numerical grading means very little if it does not take into account the relative difficulties of the different elisions. We might also mention as a third point that our study shows how complicated even the so-called simple tests are.

The data for this study were collected in the spring of 1912 from twenty-five observers, nearly all of whom were men, and who were students or members of the faculty in the State University of Iowa. If twenty-five such selected observers seem to anyone to furnish an unsuitable basis for the standardization of such a test, it is hoped that the number will at least be sufficient to furnish a suggestion as to a method of approach which may be feasible in a more extended inquiry.

The subject in each case sat at a desk conveniently lighted. Nearby one of the experimenters had a muffled telegraph key for signalling to his colleague who was attending a suitable time recording apparatus in an adjoining sound proof room. The subject, after reading a set of written instructions,² was given a sample mutilated text, which served for him both as instruction and practice. The real test blank was placed face down on the desk and on a signal was turned over and the blanks were filled in by him.

² Instructions are given in the appendix.

The sentence was used as the working unit. There are eleven of these sentence units in this test, and the average of the times of the twenty-five subjects necessary to complete each unit are as follows, in percentages of the time required for the whole test:

Value of unit	1	12.8%	6	10.8%
	2	11.7	7	9.2
	3	8.5	8	7.8
	4	11.0	9	8.3
	5	11.2	10	5.2
			11	3.4

As might be expected, the mean variation from the average time taken for each unit is in every instance rather large, emphasizing the need of a larger number of observers. The following table gives the percentage in the case of each unit which the average deviation was of the average time.

Unit	1	51%	6	50%
	2	55	7	29
	3	47	8	47
	4	39	9	55
	5	33	10	42
			11	32

In order to determine the average difficulty of the different words within each unit the subjects were asked, as each unit was completed, to distinguish three degrees of difficulty in the words supplied. They were asked to do this by underlining once and twice those words which seemed of more than average difficulty and those which seemed especially difficult respectively. The time required for doing this was not large but it was measured and deducted from the total time for the test. The relative difficulty of each elision was then estimated by the frequency with which it was marked by all subjects as of one of the three degrees of difficulty. There were, of course, considerable differences among the observers as to the relative difficulty of the various words. The first five words of the test are typical and were marked thus by the twenty-five observers:

Elided word	1	2	3	4	5
Average difficulty.....	21	21	24	19	24
More than average difficulty.....	3	3	1	4	1
Very difficult.....	1	1	0	2	0

The question which was next considered was what value should be assigned to a word of more than average difficulty and what to a word of great difficulty in proportion to the value of the word of average difficulty. At first thought, one may be

tempted to assign such arbitrary values as 1, 2, 3, or 1, 2, 4, or to say that very difficult words are so many times as hard as words of average difficulty, and that words of more than average difficulty should be assigned a value about midway between the two extremes. Introspection, however, seems to indicate that the words of great difficulty are more than three or four times as hard as the average words. It usually happened that the observer took as much time to determine a single hard word as to arrive at a solution of all the rest of the unit, and it frequently happened that even more time was spent on one hard word than on all the rest of the unit.

Now, if most of the words in the whole test had been marked as *very difficult*, only a small value, on the basis of 100% for the whole test, could have been given each word, no matter how much time it took the observer to settle upon it as the right word. On the other hand if few words were so marked, a relatively higher value could and probably should be assigned to each word marked as very hard. In other words, these three degrees of difficulty are purely subjective degrees determined by each observer, and hence the less frequently words are marked as of more than average difficulty, the more difficult they probably are compared with words of average difficulty, and the more value they should be assigned in comparison with the easier words. Hence the conclusion that the best method of assigning the values to the different blanks of the test should be based on the frequency with which each degree of difficulty was specified by the different subjects.

In answer to the possible criticism that this method is invalid because each subject's standard of difficulty would be likely to change in the course of the test, we may say that while it is probably true that few words of great difficulty were of exactly equal difficulty, it must be remembered that the subject could always tell when the solution went easily, when it was very difficult, and when it was moderately difficult. At least it seems that this method should give us more nearly the correct values than those we should get if all elisions were assumed to be equally difficult.

Acting, then, on the assumption that our method of assigning values to the three grades of difficulty is admissible, we next combine the records of all our subjects and have the following percentages of frequency:

83.2% of the elisions were marked as of average difficulty.
9.3% of the elisions were marked as of more than average difficulty.
7.5% of the elisions were marked as very difficult.

On the basis of frequency we may say that the very difficult elisions are 11.1 times as difficult as words of average difficulty, $(83.2 \div 7.5)$, and that words of more than average difficulty are 8.9 times as difficult as words of average difficulty, $(83.2 \div 9.3)$. For convenience these proportions should be reduced to fractions of unity, as follows:

Elisions of average difficulty	.048
Elisions of more than average difficulty	.427
Elisions of greatest difficulty	.533

Now the frequency with which each elision in the first unit was indicated by the observers as of the various degrees of difficulty was as follows:

Elision No.	1	2	3	4	5	6	7	8	9	10	11	12
Average difference.....	21	21	24	19	24	24	21	14	20	18	18	17
More than average difficulty...	3	3	1	4	1	1	3	5	3	4	2	5
Very difficult.....	1	1	0	2	0	0	1	6	2	3	5	5

If now we substitute for these frequencies the values for each degree of difficulty as indicated above, we have the following results

Elision No.	1	2	3	4	5	6
Average difficulty.....	1.008	1.008	1.152	.912	1.152	1.152
More than av. difficulty...	1.281	1.281	.427	1.708	.427	.427
Very difficult.....	.533	.533	.000	1.066	.000	.000
Totals.....	2.822	2.822	1.579	3.686	1.579	1.579

Elision No.	7	8	9	10	11	12
Average difficulty.....	1.008	.672	.960	.864	.864	.816
More than av. difficulty..	1.281	2.135	1.281	1.708	.854	1.281
Very difficult.....	.533	3.198	1.066	1.599	2.665	2.665
Totals.....	2.822	6.005	3.307	4.171	4.383	4.762

Therefore, the percentage of value (computed on the basis of 100% for the unit) due each elision of this first sentence is: 7.14; 7.14; 3.99; 9.35; 3.99; 3.99; 7.14; 15.19; 8.38; 10.56; 11.09; 12.05. But, since this first unit of the test is entitled to only 12.8% of the credit of the entire test, it is desirable to reduce the above determined values to a basis that will render them directly comparable with the values of all the other units of the test. This we have done by taking 12.8% of each of the values belonging to this unit. We thus obtain as the real values for

each of the twelve elisions of this unit the following: .9; .9; .5; 1.2; .5; .5; .9; 1.9; 1.1; 1.4; 1.4; 1.6.

The procedure which has been given in detail above for the first sentence of the test, was followed in getting the real values of the elisions in each of the other units. The values thus computed are given below inserted in the blanks of the test itself.

Wh.9 Willy .9 two .5 old he 1.2 .5 .5 red farm-h.9 1.9th 1.1 yard 1.4 front .14 1.6. The dan.7 were 1.5 th1.8 there; so that 1.6 2.0 lo2.2 yellow instead of 1.9.

One bright .4 Willy's m.6 put 1.7 1.6 straw .7 .9 sent him .7 .6 .6 yard to .7. She knew 1.2 1.5 had .8 high 1.3; and .4 could not o1.0 .4 gate; so he 2.2 2.3. W.5 it .3 time .5 him .3 8. .3 nap and 1.0 went .5 c.7 him, she noticed that .4 gr1.3 ma1.6 of the da.9 1.1 1.5. She won.7 where 1.3 1.1; but, as 2.2 1.2ld not talk much, 1.1 did not 1.5 him 1.7 them.

A short .6 after, while .4 was 1.1 .7 his crib, his mamma went .9 1.6 1.8 1.2 wa1.0. When .5 buck.7 came .9 full 1.0 2.2 1.6 top was all y.4 with .5. Look.8 down into .8 1.4 .6 could .6 no 1.1 at all, on1.3 1.7. 1.1 1.1 .9 wonder, then, where .5 blos.4 had 1.2. Willy .3 been .4 busy try.3 .3 fill .5 .7 .9.

If the reader will take the trouble he may compare his own introspective judgments of the difficulty of the various elisions with the values here assigned. He should remember, however, that the judgments of a single individual will frequently differ from these values which represent the combined judgments of twenty-five individuals.

It was the original purpose of the writers to correlate the degree of difficulty with the degree of correctness in the assignment of final values to the various elisions. While both of these elements must be considered in the marking of any paper, the writers decided, finally, to leave these two elements, difficulty and correctness, separate. There seemed to be no way of determining the time that would be required to make each observer's work absolutely correct. This being true, it seemed safer to base the value of the elision only upon the combined introspections of the subjects as to their difficulty than to assume some arbitrary relationship between difficulty and correctness.

Since accuracy should be considered in using the table of values here presented, we suggest two possible methods of doing it. First, give no credit for what is not correct or as good as correct. Second, give full credit for what is correct or as good as correct, and part credit for what gives sense but is not strictly correct. In neither case would credit be given for elisions left unfilled or for those filled so as to have no connection with the rest of the thought. We believe that the second method is the

fairer. An elision or a group of elisions may be so filled as to be not entirely unrelated to the rest of the thought, and yet not be sufficiently correct to warrant full credit. Thus the seventh unit, when correctly filled in, should read:

"She wondered where they were; but, as Willy could not talk much, she did not ask him about them." One observer filled it in to read thus: "She wondered where they were; but, as Willy could not talk much, *they* did not *call* him *before* them."

Then again, what proportion of the value of an elision should be deducted for words such as these in italics, which give sense but are not correct? Either of two methods might be followed: (1) an arbitrary value, say, one-half, might be deducted; (2) a credit proportional to the accuracy of the words could be assigned. The aim of the first method is to average all degrees of correctness, assuming that in the long run one word will be as much better than this arbitrary value as another is less. The second method aims to make the assignment of value a matter of individual judgment. If the papers contain many errors, we believe that the second method of evaluating would be the fairer. However, in the case of the papers used in this study there were so few errors that the first method of dealing with mistakes was adopted. The difference in the results produced by the two methods applied to our papers would be very slight. It is easily possible, however, that with some papers the results would be very different, and where this is the case the second method should be selected as the better.

We believe that the more accurate results which may be secured by using a table of individual values for the various elisions based upon the method herein described is sufficient ground to justify the little additional labor that will be required to use or apply them.

It must be remembered that the values of the various sentence units and of the various elisions which are here suggested are based on the reactions of scholastically advanced adults. It is a question whether the proportions of difficulty would remain the same if less mature subjects were tried out in the same way with the test. We have one bit of evidence to support the view that difference in maturity and in scholastic standing would yield much the same relative values. One of the investigators, Dr. Butterworth, the following winter gave this same test to one hundred first year normal school girls as a mass test. They had tried on the previous day the completion test called "The Strength

of the Eagle," to give them some familiarity with this sort of exercise. The units were separated by red lines and each subject was provided with a piece of notched card-board so that she could cover up all of the test except the unit on which she was engaged. All observers began on each unit at the same time and as each finished she raised her hand and was given her time by the experimenter from a stop-watch. Although some time was lost in the raising of the hand and the getting of the time, it was very nearly equal for all subjects. The times needed by the hundred subjects for each of the units were thus secured and averaged and percentage values of the various units were computed in precisely the same way as those given on page 4, above. The values last secured from the hundred girls are strikingly like those obtained by more accurate methods from the twenty-five more advanced subjects in the University of Iowa. Both sets of values are here presented for comparison.

	University subjects	First year normal school girls
Unit 1	12.8	10.9
2	11.7	14.8
3	8.5	9.2
4	11.1	11.7
5	11.2	12.6
6	10.8	8.5
7	9.2	9.6
8	7.8	6.4
9	8.3	7.9
10	5.2	4.9
11	3.4	3.6

APPENDIX

Instructions given to all subjects to read before beginning the test.

THE COMPLETION TEST

The observer will supply all missing words or portions of words. The length of each dotted line shows approximately the length of the word or portion of a word to be supplied.

Try first to make sense, second to fill in every omission, third, to work as rapidly as possible.

Finish one unit or sentence at a time. These are marked off by red lines.

Be rather certain before beginning to write.

After finishing each sentence, immediately underline the words which gave difficulty. Place two under any word or words which gave you noticeably the most difficulty in the sentence.

The title of this story in which you are to fill omitted words is "Where the Dandelions Went."

PSYCHOLOGY IN THE SCHOOLROOM¹

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Our educational psychologists, whose chief purpose is the solution of educational problems with the aid of psychology, have treated their subject under psychological headings such as instinct, memory, thinking, fatigue and individual differences. I believe that a mode of treatment employing educational or a combination of educational and psychological headings, would make educational psychology more practical in character and of more value to the teacher for whose use it is primarily intended. Instead of a chapter on mental fatigue, there should be a chapter on the daily program and fatigue. A chapter on attention should be replaced by discussions of the conditions of attention for the different kinds of school work, and these discussions should appear under chapters on the psychology of reading, the psychology of writing and the psychology of every other school subject. A single volume on educational psychology should give way to a number of volumes dealing with the contributions of psychology to each one of the main divisions of education respectively; e. g., the history of education, the principles of education, school administration, school management, school supervision and the principles of teaching. In this paper on "Psychology in the Schoolroom," I shall discuss, in a general way, the psychological contributions to the divisions of education just enumerated, because these divisions are all involved in the work of the schoolroom, without which they would have no purpose.

While theoretical or general psychology may be of service to the educator, it has no direct solution for the problems which arise in the several divisions of education. This is due to the fact that the purpose of general psychology differs from that of education. It is the purpose of general psychology to analyze, describe and explain mental processes, but it is the purpose of

¹ Read before the Superintendents' and Principals' Section of the Colorado State Teachers' Association, November 5, 1915.

education to improve the efficiency of these processes for school-room tasks. Psychology, directed by its purpose, deals with relatively simple mental and physical activity, often under laboratory conditions, but education, under the influence of its purpose, deals with complex activity under schoolroom conditions. For example, the psychologist is concerned with the more or less simple activity of the association of ideas, but the educator is concerned with the complex act of reading. The knowledge of association which the educator receives from the psychologist, constitutes only a starting point for determining the various associations involved in reading, and the most favorable conditions for bringing them about. In a similar manner the educator receives but a start from the psychologist for dealing with all of the other mental processes which are involved in a more or less complex way in the tasks of the schoolroom.

Child psychology has much more to contribute to the solution of educational problems than general psychology, but its purpose also is not identical with that of education and so it falls short of supplying enough educational psychology to meet the demands of the schoolroom. The child psychologist endeavors to discover the make-up of the child's mind, the nature of its development and what occurs in it, but the educator seeks to know how the mind of the child should be treated in order to realize the aims of education in the best possible way. The child psychologist wants to know the natural development of the child's mind, but the educator wants to know how to interfere with this natural development so as to reach definite educational ends. The psychologist studies the child as he is, but the teacher tries to find the best methods of changing him into what he ought to be. These differences in purpose separate the problems of the psychologist and the teacher, and make it necessary for a third individual, the educational psychologist, to study schoolroom problems with the aid of psychological knowledge.

Most of the help which education gets from general psychology, it receives indirectly through educational or pedagogical psychology. This branch of knowledge could not have been developed without general psychology as a basis or starting point. In the first place educational psychology inherits from general and child psychology a knowledge of the nature of mind, and in the second place it uses the means and methods of investigation

which are those of modern psychology. We may say, in general, that practically all the progress made in present day psycho-educational inquiries, rests upon the development of modern psychology and its methods of investigation. As to the extent to which education is dependent upon educational psychology, there are differences of opinion. Some educators believe that scientific pedagogy or education is nothing but educational psychology, but on the other hand there are educators who believe that all educational problems can be satisfactorily solved without the aid of psychology. They are of the opinion that logic, sociology and educational practice are sufficient for the resolution of all educational difficulties. Both of these views are undoubtedly extreme. The truth lies somewhere between and may be expressed in the following words: every division of education has problems whose best solution requires the assistance of educational psychology, which in some cases plays the major and in other cases a minor role.

Taking the divisions of education as enumerated at the outset, I shall endeavor to show that psychology whether general, child or educational has played a part in answering many of the questions which have arisen in each of these divisions. Students of the *history of education* are aided in several ways by a knowledge of psychology. As the history of education is suffused with psychology, psychological knowledge is helpful in the interpretation of the history of education. It is also helpful in the separation of sound from unsound teachings in the educational theories of the past; e. g., those of Pestalozzi, Froebel and Herbart. According to modern educational psychology, Herbart made many errors in his system of education. By making instruction in form preparatory only to the studies of geometry and geography, he very much under-rated the value of a knowledge of form for many activities and for such studies as drawing, reading and writing. He also made an error by beginning his instruction in form with the triangle in preference to the rectangle, which is in reality more easily comprehended by children than the triangle. In the training of right conduct, he over-emphasized the importance of the circle of thought and moral insight. In this kind of training modern psychology emphasizes practice in right action and in conduct with self-approved motives as of most importance. These are but a few illustrations

of how psychology can be of service in selecting the good and rejecting the bad in the history of education.

The *principles of education* deal primarily with the aims and the content or materials of instruction. What the aims and content of education shall be is chiefly determined by social needs and conditions, but there has been frequent recourse to psychology in the discussions on the curriculum, especially when its disciplinary value was under consideration. The formal or disciplinary value of mental work is so intimately connected with psychology, that a change in psychological conception was followed by a change from an undue belief in the formal value of school subjects to an unwarranted disbelief in their formal value. When the educational atmosphere was pervaded by faculty psychology, it was respectable for an educator to say that the larger part of the curriculum had the sole purpose of mental training. But with the passing of the faculty theory and with the appearance of the dogmatic writings of James, Thorndike and others, it has become impossible for a person to express a belief in formal training and still be respected as an educator. In recent years psychology has contributed a fairly extensive literature to the subject of the formal training of the mind, quite enough to show that the subject presents problems which are by no means easy of solution. It has also shown that the older interpretation of the doctrine of formal mental training was too radical, and that the more recent reaction to the older interpretation is decidedly extreme. Valuable psychological contributions to the subject will continue to be made until it is better understood. Meanwhile, the safest procedure in practice is to select the subjects of the curriculum for their content value and to teach them for both their content and their formal values. I believe the future will show the formal value to be greater than the content value in the elementary school. At present no one should entertain radical views on the subject of mental discipline.

I should like to call your attention to another problem, properly belonging to the principles of education, in the solution of which psychology has rendered valuable assistance. I have in mind the problem of the completeness with which the ideal aims of education can be realized in practice with certain classes of children. Psychological studies on the mental endowments of children have made it clear that, if the school is to do its work

economically and well, it must not even strive to attain for all classes of children the ideal aims of education. There are classes of children in the public schools for whom the aims must be very low, such as training in right conduct, but not in the comprehension of right and wrong; or training in weaving mats, caning chairs, and mending boots, but not in reading, writing and arithmetic. Investigations on the endowments of children have also shown that there should be specific aims in education for those children who have either superior or very different capacities from the rank and file. If these differences in aims are to be respected in practice, there must be a marked difference in the materials of instruction used for the various classes of children. It is impossible for children to cane chairs with the multiplication tables, nor can they weave mats with crayon and blackboard. For the progress that has been made in adapting the ultimate aims of education to the children's endowments, education is substantially indebted to psychology.

Psychology assists education in determining not only what the final possibilities of certain classes of children are, but also in determining what most children can do at different stages of development and what means of instruction are adapted to them during these stages. Whether paragraphing in composition work or solving a given kind of problem in arithmetic can be taught economically and profitably in a given grade, depends upon the stage of development and the mental endowment of the average child of the grade. For this knowledge education is dependent upon child psychology. To teach children in the first grade those things which involve a comprehension of long stretches of time is, according to child psychology bad and wasteful. The sense of time develops slowly and only through life experiences. There are some children in the first grade who are unable to distinguish between morning and afternoon. To introduce into the lessons of these children the time concepts of week, month, season and year would certainly be worse than useless. I shall use drawing ability for another illustration. Child psychologists tell us that before the fifteenth year, most children are unable to represent form in its completeness. Such work should therefore not be required of children before they have reached the eighth or ninth grade. To try to make the children in the third grade give a complete graphic expression of

form, would be very much like trying to make a two months' old baby walk. Instruction which is constantly devoted to teaching children the things for which they are not ready and the things which they already know must, of course, be barren of results.

School administration is chiefly concerned with the external affairs of the school such as attention to financial matters, supplying all kinds of equipment, selecting teachers and school officials, fixing the length of the school term and the attendance requirements, establishing schools and checking up the efficiency of the school system. In many of its phases this division of education is not helped by the psychologist, and, in some of its phases, his teachings must be ignored on account of other factors. For example, according to the teaching of the psychologist, children should be required to attend school beyond the age of fourteen years, because before this age they are not sufficiently developed to have excellent learning ability. On account of social conditions, however, most school systems have found it impracticable to follow the counsels of the psychologist, for they allow the children to leave school at the age of fourteen. In other phases of school administration, psychology plays a more or less prominent part. Studies on the mental fatigue of school children have shown that evening schools are unprofitable for children who work hard all day, and in this way psychology has had some effect upon the elimination of these schools.

Psychology is making its most important contribution to school administration by the help it is giving to the development of means and methods for determining the efficiency of a school system. One method which has been extensively employed and which psychology has helped to develop, finds the amount of pedagogical retardation in the school system. Assuming that the grade requirements of the different systems are about equal, that system would be the poorer which showed the largest amount of retardation. The first statistics on pedagogical retardation were published in 1907 in the April number of *The Psychological Clinic*. This journal and the psychological department of the University of Pennsylvania, have done more than any other agency to develop methods for determining the amount of retardation in a school system and for bringing the results of retardation investigations before school officials.

The efficiency of school systems has also been determined by means of the school survey. This may be so general as to involve every phase of the system, or it may be more specific in character. One survey may be entirely devoted to the subject of school sanitation, another to the subject of writing, another to arithmetic, and so on. For the purpose of measuring the quality of the children's work in some of the school branches, use has been made of standards or scales of measurement for the development of which education is indebted to psychology and the writings of such psychologists as Thorndike and Starch. There are of course superintendents who oppose the employment of these standards in making school surveys with the statement that they are worthless. That they are far from perfect every one is willing to concede, but that, even in their present form, they are useless is not acknowledged by those who have worked with them. Perhaps the opposition to them by a few politically minded superintendents is the best evidence of their usefulness. In general, psychology has been instrumental in developing methods of book-keeping for the schools which have already been widely employed.

Scales for measuring the quality of school work may indirectly be of service to school administration by improving the possibility of finding the best teachers. Other things being equal those teachers would be the best whose pupils showed the greatest efficiency in their school work. The consciousness of this possibility might have a wholesome influence upon the efforts of some teachers in practice, as well as upon the efforts of some of those in training. Extensive measurements of children's school work might even be used for evaluating the higher educational institutions devoted to the training of teachers.

The purpose of *school management* is to secure such conditions of health and school organization as are most favorable to learning and instruction. It pays attention to absences and tardiness, to the hygienic conditions of the school, the health and defects of the school children, the arrangement of the daily program, the maintenance of order and discipline in the class room and in the school in general, the requirements of home work, the gradation and classification of children, the system of promotions and provision for individual and departmental work.

Psychology is involved in the solution of some of the problems of school management. Studies on the mental fatigue of school

children render assistance in the arrangement of the daily program. They help us to determine the order in which the several school branches should be taught by giving us some idea of their fatigue coefficients and of the time of day when children do either their best or their poorest work. Studies on fatigue also give us a basis for finding the right length, number, and filling of the recess periods for children of different ages; for finding the effect of long and short recesses upon the child's fitness for work; for adapting the schedule and individual requirements to different types of fatiguability; for determining the ill consequences upon health and mental development of the child; for finding out what may be gained from a change in the kind of work, and much more of a similar nature.

Psychology, especially clinical psychology, has enhanced the efficiency of school management by pointing out the relation between certain physical defects and mental development, and by devising some of the means and methods for detecting physical defects under schoolroom conditions. Among these defects are carious teeth, arrested physical development and growth, enlarged and diseased tonsils, adenoids, defects of the nervous system, faulty nutrition and defective sense organs. The knowledge that such defects may arrest mental development and retard school progress, has encouraged school management to make greater efforts towards their prevention and amelioration or cure.

The grading, promotion and classification of children have received increased and favorable attention through the influence of studies in psychology that deal with the retardation and endowments of children. In many cities the lock-step system of promotion has been broken up through a realization of the fact that it retarded both the bright and the dull child; and special classes and schools have been established in recognition of the widely different endowments of children. Psychology has not only emphasized the need of a better grading and classification of children, but at the same time it has evolved means and methods for realizing this need. Among them are the Binet-Simon and The Point Scales for measuring intelligence, and the method of studying the family and developmental histories of school children.

As the main function of *school supervision* is to improve school practice through overseeing matters of management and methods

of instruction, I shall assume that this division of education has received consideration under the headings of school management and principles of teaching.

The *principles of teaching* are concerned with a more or less direct control of the child's moral and intellectual responses by the teacher, through the materials prescribed by the principles of education. In this field psychology has, undoubtedly, rendered its most valuable service to education. Through its analysis of many of the school subjects, such as reading, spelling, writing and arithmetic, psychology has furnished education with the necessary foundation for developing the proper methods of teaching these branches. Moreover, by supplying methods for getting at the status of the individual capacities of the child, psychology has made it possible to discover and improve or cure the specific weaknesses which so many children exhibit in reading, spelling and other school work. Among these weaknesses are poor powers of observation, poor memories, poor phonetic sense, speech defects and poor synthetic ability along one or more lines.

Such principles of teaching as may be employed in practically all kinds of school work, are also in part dependent upon psychology for their development. In a paper of this kind it would, of course, be impossible to enumerate many of these principles and show their dependence upon psychology. I shall, therefore, mention a few which are derived from studies on the psychology of learning. In drill work the repetitions should be well distributed in time, for investigations on learning have shown that this gives better results than when many of them are made in succession. Class work and seat work should be carried on as rapidly as is consistent with getting the meaning, because psychology has found that such a procedure may in the course of a few months quadruple learning ability. In studying a selection, it should be read through as a whole, because most psychological investigations on this subject indicate that this gives better results than studying it part by part. After having learned something the attention should not immediately be given to something else, because psychology maintains that this is apt to impair the retention of what was just learned. Many more principles based upon memory and other phases of psychology might be enumerated.

The subject of controlling the moral responses of children has received attention from psychology. For example, lying has been rather carefully investigated and many important results have been obtained. A teacher who has not studied the nature and causes of lying as determined by psychology and the methods of controlling it, is not as efficient as she might be in the moral instruction and training of her pupils. Many other moral reactions, as well as lying, have been given fruitful consideration by psychologists. Their studies on the relation between morality and heredity and between morality and intelligence have been especially significant and helpful to the schools and society at large.

Both good teaching and good discipline are dependent upon a knowledge of the many individual differences which appear in children, and these have been extensively treated in psychological literature. The teacher who does not know that some children have good temporary and good permanent memories and that others have good temporary but poor permanent memories, is unlikely to conduct recitations in the most efficient way. She will not realize that the former need be given very little attention and that the latter should be questioned primarily on previous lessons rather than on those assigned for the day. On account of the individual differences in the maturity for doing certain tasks, one of the large problems of the teacher is to adapt the materials of instruction to the stage of the child's mental development. This problem in its larger or group aspects evidently belongs to the principles of education, but in its minor or individual aspects to the principles of teaching. For example, the materials of instruction which are adapted to most of the children in a given grade should be discussed in the principles of education, but the materials which are best for some of the principals of the grade must be determined by the teachers.

I have tried to give you a glimpse of what psychology has done and promises to do for the work of the schoolroom. Already there is much more educationally valuable material in the field of psychology than actually finds its way into the schoolroom. The reason for this is not far to seek. It is impossible for teachers, principals and superintendents to become familiar with all of it. They could not, in connection with their prac-

tical work, make the best possible use of psychology in the schools, even though their studies were confined to psychology alone. But when we bear in mind that they must study education in its various phases, hygiene, logic, biology, sociology and a number of academic subjects, we can easily understand why they do not carry much psychology into the schoolroom. If the schools are ever to get the fullest benefit from psychology, they must employ specialists who have been trained in the use of psychology for the solution of educational problems.

COMMUNICATIONS AND DISCUSSIONS

MENTALITY TESTS: A SYMPOSIUM

(Concluded from the May number.)

1. *The point scale method versus the age-grade method.* I find myself unable to concede to the point scale method a single one of the numerous advantages which have been claimed for it. I do not see that the Yerkes-Bridges point scale, in particular, furnishes any real contrast, except in minor and unessential points, to the age-grade method of Binet. The point scale is itself an age-grade method, for its results have no known or ascertainable significance until they have first been interpreted in the light of age norms and in terms of the intelligence quotient.

Even if a point scale were desirable I do not believe it can be shown that the manner of deriving the Yerkes-Bridges scale is either logically or psychologically defensible. From the psychological point of view, especially, the arbitrary assignment of point values seems to me to have been objectionable in several respects. A point scale which is to possess any serious claim to superiority must be framed with some regard for the equivalence of points, and as far as this desideratum is concerned I believe that a more valid point scale than any yet available could be derived in less than two minutes by merely assigning two points to each test in a properly revised Binet scale, or for that matter by simply using the intelligence quotients derived by the Binet method as points for a point scale. The logical fallacies of the Yerkes-Bridges scale and the possibility of devising a really valid *equal-point scale* will be treated at some length in a forthcoming article by a Stanford University student.

All of us, doubtless, are equally desirous that any intelligence scale, old or new, shall stand or fall according to its intrinsic merit. A comparative evaluation of two intelligence scales, however, is no light matter. It requires more than off-hand criticism, more even than a little investigation or two. The proposal to decide the matter "by agreement" can of course not be taken seriously. Scientific disputes were settled that way by the churchmen of the Middle Ages, but the method is a little out of date now. When suitable revisions of the

Binet scale have been thoroughly tried out alongside of newer scales I predict there will be an end to the proposals to "scrap" the method as obsolete. Anyway, progress in this field will come, not from psychological decree, but from the demonstrable results of scientific research.

Present work at Stanford University. Until recently our time here has been taken up with work on the Stanford revision of the Binet scale. This has now been completed and will appear shortly in a monograph and a Guide to be published separately. The monograph will be devoted to an analysis of the results of 1,000 tests of unselected children, and will contain the following chapters: The distribution of intelligence; The validity of the intelligence quotient; Sex differences; The relation of intelligence to social status; The relation of intelligence to school success; Considerations relating to the formation of an intelligence scale.

The Guide, which will be issued by Houghton Mifflin Co., will contain an untechnical exposition of the Binet method and an amplified guide for the use and interpretation of the individual tests. The chapters are as follows: I. The uses of intelligence tests; II. The sources of error in judging intelligence; III. The Binet-Simon method; IV. The nature of the Stanford Revision; V. An analysis of 1,000 intelligence quotients; VI. The significance of various intelligence quotients; VII. The reliability of the Binet scale; VIII. General directions; IX-XX. Guide for use of the individual tests. The latter volume will appear about June 1st.

At present we are at work on a new scale. Some 20 sets of serial tests of widely varying nature have been assembled. In its present form this material is so extensive as to require from three to five sittings with each subject. A preliminary try-out is now in progress, from the results of which we hope to be able to select enough tests out of the entire mass to make one or possibly two or even three scales. The plan of the investigation is one that will permit the use of the same results for the formation of three types of scales—one like that of Binet, an *equal-point scale* for general intelligence, and several serial scales for separate functions. Since all of these are to be based on the same test results, it will be possible to ascertain the relative value of the different scales so derived.

Apart from this we are using the Stanford revision in studies of racial differences, of the growth rate, and of intelligence of twins, delinquents, and superior children.

The outlook for mentality tests. I believe that mentality testing will continue for some years to be mainly intelligence testing. At present this is the field which offers the largest returns for a given expenditure of effort. Moreover, after further exploration in this line we shall have a more secure basis for mentality testing of the more inclusive sort. We must not forget, too, the overtowering importance of intelligence as a factor in determining the individual's educational, social, and vocational possibilities. Largely for lack of the guidance which intelligence tests can give us, our education is a mixture of guess-work and patch-work; the data gathered by the use of pedagogical scales are equivocal; social classes and races are misunderstood and misjudged; and attempts at political and social reform go wide of the mark. I believe that social and racial psychology in particular will soon have to be rewritten in the light of results which will be secured by the use of intelligence tests.

Another important problem, perhaps the most urgent of those which promise early solution, is the determination of the growth rate. It is on this that the possibility of predictions wholly depends. I believe that in the near future it will be possible, after a brief test of even a young child, to forecast the later course of such child's mental development with a degree of accuracy as yet unthought of.

Who shall use intelligence scales? Although I am fully in accord with the recent action of the American Psychological Association in the attempt to discourage the use of intelligence tests for strictly diagnostic and research purposes by persons without extensive psychological training, I am no less equally convinced that there is no reason why every prospective teacher should not be taught how to use the Binet or some other system of standardized intelligence tests for the purpose of arriving at a better understanding of her pupils than would otherwise be possible. The technical knowledge and skill necessary for this purpose can, under the proper instruction, be acquired in ten weeks by anyone who has intelligence enough to teach school. It goes without saying that such a brief course of training does not fit one to use the tests for purposes of research or serious diagnosis, but my own experience has taught me that this is sufficient to enable the teacher to get results which, with ordinary school children, do not differ materially in one case out of twenty from those secured by the most highly trained expert. I think we must agree that a good deal which has been said *à propos* of psycho-clinical expertness (whatever that is) as a prerequisite for using the Binet

scale is hollow buncombe. As a matter of fact, there is no argument in favor of limiting the use of intelligences tests to trained psychologists which does not apply equally well in the case of pedagogical tests like those of Courtis, Ayres, Thorndike, etc. These tests, fortunately for education, teachers are specifically urged to make use of. No one has sought to envelop them in tabus for the glorification or personal advantage of the élite who have been initiated into their mysteries. Let us abandon pretense and take the same common sense attitude toward the Binet scale. When we have taken this attitude I believe we shall find that to understand and apply a well planned and well written Binet guide is as much within the power of the average teacher or school principal as it is to decipher and apply with technical correctness any reasonably complete set of directions for current pedagogical tests. Certainly there should be nothing in such a guide to compare in difficulty with the puzzling features of the Courtis manual.

LEWIS M. TERMAN.

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Ten years spent chiefly in making mental inventories of men, women and children of many sorts have emphasized for me several facts and problems as important to an efficient clinical application of psychological data. I here present them, necessarily rather tersely, for the consideration of the readers of the symposium.

1. Mental tests are of use in appraising an individual only when the one using them is able to psychologize in reference to the results, only when he is able to translate simple responses into terms of mental process involved, only when he is able to avoid confusing mental content with mental process.

This limitation carries with it the implication that the appraiser of the individual must make the tests himself, or at least watch the procedure, as a response can be fairly judged only as a part of the whole circumstance which produced it.

2. Mental tests are of use in appraising an individual only when a *rapport* is established between the experimenter and the subject. If the subject is intimidated or repelled by the examiner or by the surrounding conditions a true estimate of his ability can not be made. On this account rapid examinations for diagnostic purposes are unjustifiable.

These two facts are not grasped by that large body of public spirited men and women who are making a sincere effort to evaluate the con-

tribution which clinical psychology is offering toward the solution of certain social problems. On this evaluation the clinical psychologist's opportunity for social usefulness in the near future largely depends. It seems the part of wisdom and fairness to let it be more generally known that a mental appraisalment of an individual is even more dependent upon the adequate training and quality of the examiner than upon the standardization of the tests used. In further emphasis of the large field in social service now opening before the clinical psychologist I shall add that during the last six months twenty social agencies of Chicago and its environs have sent problem cases to the Orthogenic Clinic at the Rush Medical College for mental evaluation and advice as to course to pursue.

3. In the examination of adult subjects I have long used a series of selected tests designed to give an approximately complete mental analysis. The series is arranged in four sections in accordance with the recognition of three fundamental mental processes—sensation, reproductive memory, and apperception—and their final expression in volitional movements. These sections are subdivided rather extensively, each subdivision being provided with one or more tests. The arrangement is convenient in that tests bringing into play the same mental processes but calling for less mental content may be substituted when necessary.

4. The final Binet-Simon revision of the Binet-Simon Measuring Scale, I have found of unequalled value in diagnosing and classifying defective children. There are of course many cases, especially cases of children with defects as opposed to defective children, to whom this series of tests is absolutely inapplicable. I believe that the series is a valuable tool when used by an adequately trained person, who knows when to use it and when to lay it aside for other more appropriate tools. In less expert hands, far from being a valuable tool, it is even a dangerous one, owing to the popular belief in its innate and almost uncanny power of detecting the subnormal child.

5. I find a distinct need for tests which require the controlled interplay of disparate mental processes, and yet call for no rich mental content. There are many tests for complicated mental activities adapted to persons of culture, but not many which call for equally complicated mental work while making no demand on mental content. Many of our adult subjects are densely ignorant and yet capable of sustained controlled mental effort. We need tests to bring this out.

Tests of learning ability which require practically no apperceptive background are also needed. Such tests are of great value in the examination of those who do not speak our language.

I also find a definite need for tests to determine the ability to oppose suggestion by a critical self-reliant survey of the situation. Extreme suggestibility is the trait which more often than all others brings the subnormal person into conflict with society and with the law.

At present I am endeavoring to develop tests along the three lines just indicated.

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1. One of the greatest needs at the present time in the field of psychological diagnosis is an extensive experimental and critical study of the relative value for purposes of practical diagnosis of the larger number of individual tests which are now available; and, once this value has been satisfactorily determined, we need to establish norms for these tests and to determine the best method of arranging the norms or the tests.

We must determine by critical studies what criteria can be employed for determining the value of the tests which should be included in a measuring scale. Shall we use as a criterion the degree of correlation which exists between different tests or between a given test and the child's success as judged by social or educational criteria? Shall we select the tests on the basis of their elemental character in accordance with Professor Seashore's suggestion? Or shall we prefer the more complex tests, which more nearly resemble the actual complexities of the life situations? Shall we seek tests which systematically explore the fundamental traits of any given phase of mentality, say, of intelligence or motor capacity? Or shall we merely assemble empirically a series of loosely related tests which meet the pragmatic test—which seem satisfactorily to measure the different functional levels from infancy to maturity? That is, will the ideal scale be eclectic in character, including any tests that prove of value, whether or not such tests fit logically into a predetermined system? Shall we include only tests which are easily and rapidly administered? Or shall we include cumbersome tests which require 5 or 10 minutes to give? One of the recent scales contains lengthy,

cumbersome tests which do not seem to justify the time needed to give them. Shall we include tests which measure the extent to which the individual has profited from experience, or, in other words, which show capacity for improvement, an important element in mental diagnosis?

These are questions which, I believe, still await satisfactory solution. Personally I feel that we should seek primarily for tests which measure inherent strength or *capacity* as against mere *attainment*, but this distinction cannot be drawn too sharply because the strength of different traits after early infancy is the resultant of two factors; first, the development which is due to hereditary propulsion and, second, the development which is due to the experience of the individual. I believe, also, that we must use more relatively complex than simple tests. But, in any case, the tests must be of such a character or be so arranged as to measure mental development from stage to stage up to the point of mental maturity, if such a point can be definitely determined. I should hesitate very much to say, with Professor Yerkes, that this point comes approximately at 16. Some traits probably mature at 15, others at 16, and still others at 20 or later. This is another question which must be carefully determined and until it has been satisfactorily determined it is the part of discretion not to announce any hypothetical figure, because the moment such a figure is announced some examiners will utilize it as a demonstrated fact for purposes of practical diagnosis, just as arbitrary and hypothetical standards of feeble-mindedness have been inadvisably used in connection with the Binet scale. My present position, then, is entirely in harmony with Huey's view that "Mind grows on to a maturity not complete till in the twenties. Indeed it grows further, normally, in a transformation with the life cycle, to a different character and strength, harmonious with and normal to each period of chronological age. What are the norms and the tests then for the levels of 14, 16, 20, 24 years? And what are the most significant functions to which we shall apply these tests and norms?"

In the same way, once the tests have been selected, we must determine either by theoretically acceptable scientific criteria, or by considerations of practicability and workability, the best method of arranging them and computing the results, whether according to the age-gradation method, or the point scale method, or a combination of the two, or some other method. The Binet scale has fallen into considerable disrepute, but this is due less to the inherent defects of

the scale itself, which many workers for long have pointed out, than to the unfounded claims which have been put forth as to its amazing accuracy, its wonderful diagnostic possibilities, bordering on the infallible within limits which have been broadly specified, the rigid standards which have been arbitrarily proposed for the determination of feeble-mindedness, and the wide use which has been made of the scale and the proposed arbitrary standards for determining the number of pupils, criminals, prostitutes, etc., who are feeble-minded, by persons who are psychologically unqualified to make mental diagnoses. These extravagances, and perverted applications of the scale, not justified by anything authorized by Binet himself, have evoked sharp criticisms by those who cannot sanction this type of science, but these criticisms, unfortunately, have frequently been interpreted as criticisms of the scale itself rather than of its perverted uses. Within its limitations, in spite of all its shortcomings, I have found the scale of very considerable value, and shall probably continue to use it (give both the 1908 and 1911 tests and rate my cases by both scales) until a superior system has been evolved. I must, however, confess to a certain prejudice in favor of the Binet arrangement, as I have used it continuously for six years and have become accustomed to make subjective allowances and supplementations and to rating examinees in terms of this scale. I do not, of course, approve of the idea of making all the age-steps uniformly represent one year of development. In the earlier years smaller units, say, one-third or one-half year units, may be used, while in the upper years the unit may be made larger, covering, say two or three years.

One of the patent advantages of the Binet method is the formulation of the result in terms which can be easily comprehended by the average person, and which have considerable significance, namely in terms of mental age (or the equivalent normal chronological age). While this method also has its disadvantages, I am not certain that the disadvantages can be overcome by the point scale method of rating. It would be difficult to use the pooled sum from the accumulation of points for diagnostic purposes during the *period of mental growth* without translating them into terms of normal chronological age, or successive developmental units. Seventy-five in the point scale would mean something entirely different for a five-year old than for a ten-year old. For adults it might have approximately the same significance, due allowance being made for such factors as Yerkes has specified. Nor do I see that this difficulty would be sur-

mounted by the use of the three scales proposed by Yerkes to cover successive four year periods of development from 0 to 16, for, if I am correct, the pooled sum from each scale would still have different meanings for the children of the different ages or stages of development included in each scale. A scale of intelligence for school use must aid the examiner in distinguishing between the children who should be assigned to special schools for the feeble-minded and those who should be assigned to ungraded classes for the borderline, backward and merely retarded. In order to serve this purpose the scale must supply norms for each age or stage of development from the age of school entrance to at least the mid-adolescent years.

It would, of course, be possible to test children of different stages or ages of development and establish a pooled norm for each stage of development, and then state the results for any child examined in terms of the per cent. of the normal result for his age. In such a case we should have to determine independently (1) the exact significance of any given percentage of normal functioning, say 60%, and (2) whether 60% of normal capacity at, *e. g.*, age four would have the same significance for diagnostic purposes as 60% capacity at age 12, 16 or 20, which I am inclined to doubt from my experience with the intelligent quotient.

2. It is still a question whether norms of performance can be secured by testing an unselected array of children including the abnormal as well as the normal. We do not standardize the clinical thermometer, or establish norms for the pulse rate on the basis of pathological material. The most recent norms for the Seguin form-board based on a selected array of normal pupils (75% average and about 12.5% each dull and bright) are quite different from the earlier norms which were based on unselected arrays or only partly selected arrays. Shall we standardize medical tests on the basis of healthy material, but psychological tests on the basis of both normal and abnormal material? The theoretical solutions thus far proffered to this question are not, to my mind, conclusive. The question needs further consideration.

3. We need a series of fundamental tests and norms of what I may designate psycho-motor capacity. By tests of psycho-motor capacity I do not refer to tests merely of motor strength, coördination, steadiness or speed, although all such tests involve a modicum of attentive control and perceptual analysis; but I refer to motor problems, the skillful solution of which puts a premium upon the individual's keen-

ness of observation, power of intellectual analysis and perceptual discrimination, ability to adjust himself to a novel situation and to profit from the memory of former adjustments. Not the least advantage of such tests is that they are relatively independent of the individual's linguistic ability. There are no scales which will compare in importance, I believe, with those of intellectual and psychomotor capacity. I am at present attempting to secure norms for a very simple series of peg form-boards, but this work proceeds slowly as the practical work of classifying, diagnosing and prescribing for the clinic cases and the offering of instruction consumes my time.

4. The testing out and standardizing of tests, the arrangement of tests into scales, the establishment of thoroughly reliable norms and the working out of diagnostic indices represent a large program of work which will require the cooperation of many workers during a number of years. This work should be undertaken by a station of psychological tests and standards, supported on an adequate scale either by a private research foundation or by a government subvention. The station should command a budget of about \$50,000 annually. If this work is worth doing at all it is worth doing well. In order to obtain reliable norms it would be desirable to test many thousands of cases from infancy to maturity. The needs of such a bureau have been presented before, but no effective action has yet come from the agitation. Since the securing of proper financial support for a research bureau is problematical, the logical agency to organize the work is the American Psychological Association (or the Society of College Teachers of Education). An "association scale" would command wide acceptance. But the construction of a satisfactory scale would require the coöperation of quite a number of workers during a period of five or ten years. No doubt, much valuable preliminary work could be done by a committee on diagnostic tests and standards.

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Mental testing is an aspect of applied psychology that has assumed rather too elaborate and dignified proportions to be longer regarded, even by its critics, as a passing fad. Like all new movements that promise to bring scientific conceptions and technique into the service of society, it has suffered somewhat at the hands of friends in whom

eagerness exceeded exactitude, and it has suffered likewise in the hands of charlatans who have never scrupled to trade upon science for their private gain. In the main, however, progress in mental testing has been, I think, as real and as striking as in any field of pure or applied psychology.

The period when experiments as developed in the laboratory of pure psychology were taken over with little modification as mental tests has been succeeded by the period in which tests have been devised with more immediate view to their purpose, and dilettante dabbling with isolated tests has been largely supplanted by more or less elaborate attempts at the construction of systems or combinations of tests so ordered and so pooled as at once to probe mentality from various angles and to summarize the result in a single index of mental status or mental ability.

I take it that the pressing practical need for a measure of general intelligence has been the incentive to the development just depicted. We have this practical need to thank for the Binet-Simon tests with all the astounding wealth of comment and criticism (witness Kohs' list of 254 titles prior to May, 1914), and the varied and stimulating efforts to improve and revise this famous series of tests. Many workers have felt, and strongly, that much of the too-amateurish application and exploitation of Binet's device is not only a deplorable waste of energy but also a direct check upon the development of this important aspect of mental testing. With this view I am mainly agreed, though I do not feel quite so strongly as do some of my colleagues that erroneous diagnoses are likely to be made when the testing is in the hands of persons who have the requisite psychological training, just because a given formulation of these tests is used rather than some other one. We must meet these difficulties, I think, primarily by rigorous training of those who make a business of testing for diagnostic purposes. The great need of the tester is that he shall come to "feel" the conditions under which testing is reliable almost intuitively. The possibility of establishing some sort of standardizing bureau by the appointment of a committee for determining, once and for all, just how the Binet tests, or any other tests, shall be administered seems to me to become daily more remote and difficult. I expect, rather, that the best methods will emerge on their own merits and from individual initiative when they shall have proved these merits by the pragmatic test of "delivering the goods."

It is evident that the Binet-Simon scale, or any superior substitute for it that may be developed, is, after all, of pretty limited service:

when the broader possibilities of mental testing are considered. We need right away, for instance, some similar set of tests for providing a reliable scale for the general intellectual level of adolescents. Take here the single illustration of the need for satisfactory standards of mental capacity for college entrants. My own notion of the method to be followed in meeting this need and others like it is roughly as follows: (1) Prepare from *a priori* considerations a list of the part-functions that appear to constitute the main ingredients in "general intelligence." (2) Draw up a list of the mental tests available that appear most clearly to measure off these part-functions. (3) By trial refine these tests until their technique (instructions, arrangement of material, rules for scoring) is reasonably well perfected. (4) Apply the revised tests upon a good-sized group of subjects. (5) Draw up correlations between the results of these tests themselves, and between each of them and several other appraisals of general intelligence (school-grades, estimates of teachers, success in daily life, etc., all with the best precautions that we have to insure reliability). (6) Wherever two or more of the tests correlate with one another to a marked or high degree, discard the poorer one or ones (as being substantially measures of the same part function or functions). (7) Wherever a given test shows a very low correlation with intelligence discard it. (8) With the tests that remain try the pooling or amalgamation of their results according to various loadings to discover that weighting of each that shall yield the highest final correlation with the presumably best appraisal of general intelligence. (9) Lay off the percentile distributions for each of the selected tests and for their amalgamated indexes, with proper regard, if need be, for dependence on sex, age, and social and academic status. (1) Determine on these distributions the "dead line" above which performance must rise in order that success in university work or in various other directions may be predicted. This program is scarcely new; perhaps no portion of it is new, but I think no investigator has carried it through completely. I have been toying with parts of it for several years, and a more serious attack upon it is now under way at the University of Illinois, of the details of which it would hardly be appropriate to talk just here.

There is one other aspect of mental testing that seems at times to be quite lost sight of in the present anxiety for diagnosing general intelligence. I refer to the use of mental tests for the intensive and rather precise analysis of the specific abilities of an individual for the

construction of what Stern calls "psychograms" of individuals. This is clearly a different undertaking from the determination of level of general ability. Yet many of the problems that confront the applied psychologist do assume this specific aspect. Thus, in attempting to diagnose the sources of difficulty that prevented certain students from achieving adequate results in their academic work I sought in a few cases to undertake a fairly extensive exploration of their mental equipment; but this work has been greatly handicapped for lack of any well-justified program of testing and for lack of reliable norms with which to compare the performances of these students as they were determined. I should welcome the publication of numerous comprehensive analyses by mental tests of the mentality of individuals, especially of individuals that presented exceptions to the average—either by superiority or inferiority. It might well be that these interesting special cases would come to group themselves into certain roughly defined types so that prognosis would become relatively simplified. I seem, for example, to have encountered several cases of failure in secondary school and college work in which general intelligence was average or better, but in which a fundamental inability to deal readily with linguistic symbols rendered ordinary school progress well-nigh impossible.

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EDITORIAL

A person with whom we are well acquainted and with whom we frequently discuss educational problems, has rather pronounced views upon educational values. Most people have, for that matter. These particular views, however, are unique in that the person referred to formulated them pretty early in life and consistently applied them to the later stages of his own education. He was left fairly free to choose most of his studies, and he deliberately made this choice upon the basis, not of interest, but of distaste. His reasoning was simple: he wished to take advantage of the stimulus of class-work and of the systematic routine of required effort in order (as he states it) to "train" the capacities in which he was obviously weak. His was a naïve educational philosophy in which the doctrine of formal discipline (strongly impregnated with Calvinism) played an important part; but he is morally certain that his philosophy "works."

And very likely it did work and will work within reasonable limits. To give the will some "gratuitous exercise" every day will doubtless have the salutary influence that James ascribed to the practice. The chief difficulty in adopting it as an educational policy lies in making

certain that the exercise is "gratuitous." But the important question just now is whether this type of training represents anything more than the possible development, ideal of mastery over immediate desire and interest. Does it really represent beyond this a training of more specific capacities, and is it wise to train these capacities if they do not have the advantage of innate strength? If I find mathematics so distasteful that I avoid mathematical work whenever possible, will even a gratuitous effort to master mathematics result in an improvement in ability that is proportionate to the time and energy expended, or an improvement that will compensate for the loss of opportunity to spend this time and energy in developing a capacity that shows greater promise?

This problem, we believe, lies at the center of current discussions regarding curriculum-reorganization. It is in part a psychological

ITS BEARING UPON CURRICULUM READJUSTMENTS

problem and in part a problem of general educational theory. Psychology must answer the questions, "In how far does distaste mean lack of native ability? In how far can weak native ability be developed by specific training?" General educational theory must answer the question, "Is it worth while to make the attempt?"

There is at present a strong disposition upon the part of school administrators and of an influential group of educational theorists to answer the latter question in the negative. School administrators are feeling more and more keenly the pressure to adjust curriculum materials to varying capacities; the increasing numbers of pupils retained for the high school is continually intensifying this pressure. The type of adjustment that makes the strongest appeal is that which would provide different subjects for individuals and groups of varying capacities. Some of the larger difficulties and dangers involved in an extreme or a premature application of this theory have been pointed out by the present writer, primarily upon the ground that the needs of democracy demand a certain community of culture, and that a reasonable measure of uniformity in curriculum-materials will work toward this end. Others, however, have a somewhat different conception of democracy, and believe that the largest possible latitude for individual development—the most intensive training of the most pronounced native abilities—will serve to realize the democratic ideal much more effectively than will any attempt to secure uniformity in culture.

There is certainly abundant room for argument in connection with this problem, but this is the phase of the question that must be solved

HOW FAR IS IT PRACTICABLE TO TRAIN WEAK ABILITIES? by general educational theory rather than by educational psychology.

What educational psychology can do, however, is to lay bare the facts. It can answer the two questions just stated, and there is especial need just now for answering the second of these—"In how far can weak native ability be profitably trained?" There are some high-school pupils for example, who seem to profit in no way by the study of algebra and geometry. Assuming that these subjects furnish the best available means for giving one a conception of what abstract and symbolic thinking means, and some valuable exercise in this type of thinking (an assumption which can be theoretically defended), is this value to be realized in any appreciable measure among those pupils who find these subjects extremely distasteful? It is at least conceivable that the trouble which many pupils experience in connection with these subjects is greatly intensified by the fact that they are continually measuring their weakness against the strength of others. Under such conditions, of course, discouragement and its consequent depression form what might be called an extraneous or factitious handicap. The administrative expedient that at once suggests itself in this case is differentiation of classes on the basis of standards of accomplishment and rate of progress. But the fundamental question is whether any progress that is possible under these conditions is really worth while.

The same question arises not only in connection with every subject for which a disciplinary outcome is primarily assumed, but also in connection with such subjects as history, literature, and the biological sciences all of which are commonly justified upon the basis of informational and appreciative outcomes. (We note with apprehension, for example, that history does not appear in some of the curriculums proposed for junior high schools. Does this mean that pupils are to be trained for "citizenship" with only the simple, biographical history that is taught in the lower grades, and largely because some boys and girls do not "take" to this subject?) But the problem is especially acute in connection with studies that are intrinsically difficult because they demand a relatively high type of conceptualizing ability.

The older view of mental discipline assumed a direct relationship between the difficulty of a subject and its disciplinary value—an assumption that is eminently well adapted to encourage careless teaching—and, on the other hand, an assumption that handicapped the doctrine with an adventitious disadvantage when the day of skepticism dawned. (The lines of greatest resistance are very naturally unpopular.) With the reconstruction of the doctrine, too, the possibility of this direct relationship has been pretty carefully avoided. If, however, “general” training depends primarily upon the possibility of lifting a procedure to the conceptual level, and endowing it with a consciousness of worth, it is possible that the older assumption possesses a measure of truth.

This possibility was suggested in an interesting way by a fact that came to the writer’s attention a few days ago. In the College of Agriculture at the University of Illinois, several courses in “stock-judging” are either required or elective in many of the curriculums. In any case, large numbers of students “take” practically all of these courses. There seems to be no requirement regarding the sequence, but the students themselves have “hit upon” a definite order which has, we understand, become a tradition. The course dealing with “sheep-judging” is almost always elected as the first course. When we inquired into the situation, we found that the tradition carried with it a reason that was quite conscious to the students. Sheep-judging is much more difficult than the other courses. Nor did the reasoning stop at this point. The students definitely affirmed that because of this difficulty they were compelled in this course to develop a “method of procedure,”—in other words to “conceptualize” the process; a necessity that did not arise in like degree in the other courses. Once in command of the method, the other courses were “easy.”

The situation reminds us of the tradition regarding the strenuous mathematical training that has been associated with the Cambridge degree, and of the answer which a Cambridge man is said to have given when asked what advantage he gained from the severe mathematical discipline when he never used his mathematics afterward. “It was valuable,” he said, “because, after that strenuous experience, everything else was easy.”

In any case, the relation of difficulty to mental mastery is a significant question—a question that studies of initial distaste and sub-

sequent progress might go a long way toward answering. It is pretty clearly apparent at the present writing that the ideals reflected in the organization and administration of the people's schools have a profound influence upon the progress and destiny of the nation. Present-day ideals and tendencies in American education certainly do not smack of virility and strength, whatever else may be said of them. They may be worthy ideals—but they bear scrutiny.

W. C. B.

NOTES AND NEWS

At Albany, New York, a number of philanthropic citizens interested in social welfare have organized the Albany Social Science Society with Dr. Clinton P. McCord as president. The purpose of the society is to disseminate the principles of a sound and practical knowledge of social welfare work in the city and county of Albany, through such channels as conferences, lectures, exhibits, and scientific and popular writings; to serve as a place of clearance for scientific information regarding the various phases of charitable and social activities; to establish scientific standards in the field of local social welfare work; and to review critically all measures or plans suggested as desirable in the local field of social welfare work. There are to be special sections or groups for the subjects of crime and delinquency; settlements and clubs; private charities; health; institutions; city and county charity; socialized education; and local state officers' social problems. Active membership in the society may be secured by all those interested on payment of the membership fee of two dollars.

The Department of Educational Investigation and Measurement of the City of Boston under the direction of Dr. Frank W. Ballou has recently issued a bulletin of twenty-five pages devoted to the determination of a standard in accurate copying of English. The test was given to 4,494 first-year pupils in Boston high schools, and the results were scored with reference to spelling, capitalization, omitted words, added words, wrong words used, misplaced words, punctuation, undotted "i's," and uncrossed "t's." The average number of errors per pupil was 5.54. The largest group of errors was undotted "i's," 8,794. Spelling and punctuation came next with 5,800 errors each. The boys make a larger proportion of errors than the girls.

The subject of formal discipline is evidently receiving a great deal of attention from psychological and educational writers. In addition to W. G. Sleight's book "Educational Values and Methods Based on the Principles of the Training Process," which appeared last summer, and J. E. Coover's elaborate monograph on formal discipline, noticed in another section of this issue, the firm of War-

wick and York announces the forthcoming publication of no less than three books on this subject. They are Nellie P. Hewins' "The Doctrine of Formal Discipline in the Light of Experimental Investigation," Chang Ping Wang's "The General Value of Visual Sense Training in Children," and Harold O. Rugg's "The Experimental Determination of Mental Discipline in School Studies."

The Texas State Department of Public Health, the Extension Department of the University of Texas, and the International Health Commission have undertaken a sanitary and health campaign in Leon County, Texas. Three districts in this county, situated in and near Navasoto River and tributary creek bottoms, where the malaria and hookworm infection is very heavy, have been chosen for intensive work. The campaign involves making the necessary examinations of each individual in the three districts for hook worm and malaria and treating until cured those found infected. In order to partially determine what improvement results from treatment all the school children in the three districts have been tested and examined with the following tests: (1) Thorndike Reading test, (2) Courtis Arithmetic, (3) Starch Arithmetic, (4) Trabue Completion, (5) speed of tapping, (6) vital capacity, (7) weight, (8) strength of grip. The first four tests mentioned have each been divided into two parts of equal difficulty. The children have been tested with the first parts of each of these tests and will be tested, at the conclusion of the campaign, four months later with the second parts. In this manner the improvement of those (1) not affected, (2) affected and not treated, and (3) affected and treated, can be compared. Doctor P. W. Covington of the International Health Commission and Dr. E. W. Breihan of the University of Texas Extension Department are conducting the health campaign, and Dr. Truman L. Kelley and Mr. D. L. Hoopin-garner of the Division of Child Welfare of the Extension Department of the University of Texas are conducting the mental and physical tests of the school children.

Professor E. A. Kirkpatrick, of the Fitchburg (Mass.) State Normal School, will give a course of lectures the coming summer at the State Normal College at Greeley, Colo., the State College at Pullman, Wash., and the State University at Eugene, Oregon.—*School and Society*.

On March 21 Dr. Shepherd Ivory Franz of Washington, D. C., addressed the students of Swarthmore College on "The Psychology of Delusions" and on the 27th Professor Warner Brown of the University of California spoke on the "Psychology of Advertising." Dr. Bird T. Baldwin of Swarthmore will give the undergraduate and graduate courses in Educational Psychology at Johns Hopkins University during the Summer Sessions.

Dr. David Spence Hill, Director of the Bureau of Educational Research, New Orleans Public Schools, will be a member of the faculty of the University of California Summer Session.

George Ordahl (Ph.D., Clark University), formerly Professor of Psychology and Education, University of Nevada, and for one year State Psychologist, Lincoln, Illinois, now connected with the Buckel Foundation for the study of Backward and Defective Children, Standard University, has been appointed psychologist and educational director at the Sonoma State Home, Eldridge, California.

Dr. J. Carleton Bell, for the past four years professor of the art of teaching at the University of Texas, will return to the Brooklyn Training School for Teachers in September.

PUBLICATIONS RECEIVED

(Notice in this section does not preclude a more extended review.)

Academic Status of Psychology in the Normal Schools. Report of the Committee of the American Psychological Association on the Academic Status of Psychology. Princeton: December, 1915. Pp. 33.

Part I of this report was prepared by Professor Margaret F. Washburn, of Vassar, and deals with the training of instructors. It is significant that many heads of normal schools look with suspicion upon the trained psychologist, and frankly avow that they prefer a good teacher who has had little training in psychology. Part II discusses the present status of the teaching of psychology, presenting charts to show the required work in psychology, subject matter, size of classes, laboratory equipment, and aims of work. This section was prepared by Professor Bird T. Baldwin, of Swarthmore. An appendix gives sample outlines of courses of study.

J. MACE ANDRESS. *Johann Gottfried Herder as an Educator.* New York: G. E. Stechert & Co., 1916. Pp. 316. \$1.25.

A well-written account of Herder's life, and a careful appreciation of his contributions to the educational thought of his time. Three-quarters of a century before Darwin he expounded the essential principles of evolutionary thinking in such a manner that they became a part of the German viewpoint in education.

NORA ATWOOD. *Theory and Practice of the Kindergarten.* Boston: Houghton Mifflin Company, 1916. Pp. ix, 185. 60c.

This little book is designed to aid the young kindergartner in adjusting herself to the actual work of dealing with children, and to bridge the gap between theory and practice. There is a detailed discussion of the kindergarten program, the kindergarten gifts, the use of the story, and the relation between the kindergartner and the primary teacher.

CLARENCE R. AURNER. *History of Education in Iowa. Volume IV.* Iowa City: State Historical Society of Iowa, 1916. Pp. xi, 470.

The fourth volume of this comprehensive work deals with the history of Iowa's three state institutions of higher learning, the State University, the State College of Agriculture and Mechanic Arts, and the State Teachers' College. The book is a model of clear and forceful historical exposition, and is a most admirable contribution to the history of higher education in America. If other states would follow

the example of Iowa, we should soon have the materials made available for a complete and definite understanding of educational movements in this country.

JAMES H. BAKER. *American University Progress*. New York: Longmans, Green and Company, 1916. Pp. 189. \$1.00.

"This book is not merely a study of the American university, but also of problems of college and school and of sociology. Throughout is found reference to the reorganization of American education, economy of time in education, and the relation of education to service and to social administrative efficiency, and special chapters are devoted to these themes. The whole volume deals with present conditions and constructive ideals."

JESSIE H. BANCROFT AND W. D. PULVERMACHER. *Handbook of Athletic Games for Players, Instructors, and Spectators*. New York: The Macmillan Company, 1916. Pp. xxv, 627. \$1.25.

This volume contains all that anyone needs to know about the leading athletic games, such as baseball, basketball, football, hockey, golf, handball, tennis, lacrosse, polo, track and field games, running and walking races, jumping and pole vaulting, weight, throwing, and rowing. The discussion of each game includes a description, rules, suggestions for play, a history of the game, a good working bibliography, and a glossary of the terms used in it. It is a very complete and serviceable handbook, and will doubtless be widely used in school and college circles.

WILFRED M. BARTON, M.D. *Manual of Vital Function Testing Methods and their Interpretation*. Boston: Richard G. Badger, 1916. Pp. 255. \$1.50.

This is a strictly scientific book, and brings together the results of widely diverse observations and experiments in a manner which unfortunately is only too rare in medical treatises. "The great strides which have been made in recent years in all departments of vital functions exploration, the discovery of new methods and tests, together with the mass of casuistic and critical literature that has appeared, have rendered it highly important that all this correlated material should be collected together in book form." The functions considered include those of the liver, kidneys, pancreas, heart, and ductless glands.

RANDOLPH S. BOURNE. *The Gary Schools*. Boston: Houghton Mifflin Company, 1916. Pp. xix, 204.

This is an enthusiastic account of the Gary schools by an ardent advocate of the plan which Superintendent Wirt has evolved. From such a source we should not expect adverse criticisms, and those that receive any notice whatever are promptly disposed of. It is a sig-

nificant fact that the Gary schools are more imposing to the layman than to the educational specialist, and while we may readily acknowledge the administrative genius exhibited in the scheme, we should not let this blind us to patent weaknesses on the instructional side. The book is well written, and will win many friends for the Gary scheme.

ERNEST R. BRESLICH. *First-Year Mathematics. Fourth Edition.* Chicago: University of Chicago Press, 1916. Pp. xxiv, 345. \$1.00.

With the marvellous growth of secondary education in the United States in the past two decades there has arisen an increasingly critical attitude toward the course of study. Both parents and teachers are subjecting the high school requirements to a rigorous inspection to determine whether the time spent on them is most profitably employed. Particularly do the traditional courses in algebra and geometry arouse misgivings. The subject matter of those courses is arranged in a formal rather than a natural manner, and as a result they are the most difficult subjects of the curriculum and give rise to the highest percentage of failures. In the present text the author has endeavored to combine into a single year's work the introductory aspects of algebra, geometry and the theory of numbers, and so to graduate the difficulty of the advance that the pupil will appreciate the significance of mathematical studies in life and will be stimulated to interest in and enthusiasm for them. To this end much stress is laid on biographical and historical materials, and there is frequent use of graphs from the first chapter on. The text will be especially welcome to the increasing number of superintendents who believe that only one year of mathematics should be required, and that thereafter all mathematical courses should be elective.

ALBERT PERRY BRIGHAM AND CHARLES T. MCFARLANE. *Essentials of Geography.* Cincinnati: American Book Company, 1916. First Book, Pp. vi, 266. Second Book, Pp. vi, 426.

These two geography books constitute a triumph of the bookmaker's art. The illustrations are magnificent, the maps are clear and well executed, showing both physical and political features of each group of states, and the text is excellently adapted to the needs of the pupils. In the hands of a skillful teacher these books should induce children to love geography above all other subjects.

FRANK FORREST BUNKER. *Reorganization of the Public School System.* Bulletin 1916. No. 8. Washington: Bureau of Education, 1916. Pp. VI, 186.

This very interesting monograph presents a historical survey of education in the United States from colonial days to the present,

with emphasis on the changes in school organization which have taken place in the last two decades.

JOHN EDGAR COOVER. *Formal Discipline from the Standpoint of Experimental Psychology*. Psychological Monographs. Vol. 20, No. 3. January, 1916. Whole No. 87. Pp. VIII, 307.

Part One of this scholarly monograph gives an orientation in the subject, recounting briefly the most important results of previous experiments. Part Two, comprising over two hundred pages, reports the results of experiments with such material as marking out words, estimating weights, visual and auditory discrimination, and two extended series of tests on attention and on reproduction. The author concludes that even the simplest exercises involving attention and reproduction are extremely complex processes from the point of view of the mental activities involved. The "common factor" underlying two types of behavior or two different experiences may be cognitive in its character or may consist in emotional and volitional attitudes. In the latter case it is frequently more effective in making general the results of special practice than in the former. Purely specific reactions are non-existent. There is always a certain "spread," and the question is how significant is this "spread" for responses to other situations. The general effects of practice in these relatively simple mental activities are so great that there is good reason to believe that work in the more complex school subjects through a series of years has a very much greater general effect. There is a very complete bibliography of thirteen pages, and an appendix of forty pages presenting tables and graphs of results. It is undoubtedly the most elaborate investigation of the subject of formal discipline that has yet been attempted.

J. FORSYTH CRAWFORD. *The Relation of Inference to Fact in Mill's Logic*. University of Chicago Philosophic Studies, No. 5. Chicago: University of Chicago Press, 1916. Pp. 50. 50c.

A thoroughgoing discussion of Mill's view of inference.

GEORGE W. CRILE. *Man—An Adaptive Mechanicism*. New York: The Macmillan Company, 1916. Pp. XVI, 387. \$2.50.

In this interesting book the author has gathered together from a wide range of sources, chiefly biological and medical, the data that seemed to him to prove that man is a mechanism that has developed in adaptation to the influences of the environment. Chapter One presents many illustrations of adaptation and applies these to the elucidation of the term. Subsequent chapters discuss the nervous system as an instrument of adaptation; the receptive organs, with emphasis on chemical changes and their relation to the emotions; the kinetic system, consisting of the brain, the thyroid, the adrenals,

the liver and the muscles; and a series of chapters on the biological interpretation of health and disease. In the latter group of chapters the author discusses from a purely mechanistic point of view such phenomena as the action of drugs, sleep, pain, laughter, weeping, and the electro-chemical manifestations of the living organism. The book contains a large number of illustrations.

C. O. DAVIS. *High School Standings of Pupils from Graded and Ungraded Elementary Schools*. Reprinted from Educational Administration and Supervision, March, 1916. Pp. 159-174.

Pupils from ungraded schools tend to fall behind those from graded schools in the early semesters of the high school course, but if they persist in school, they equal and finally surpass their fellows.

G. V. N. DEARBORN. *Economy in Study*. Scientific American Supplement, April 15 and April 29, 1916.

The first of these papers contains pertinent hints on how to observe and how to take notes; while the second deals with educative imagination. Of the latter the author distinguishes three types: reproductive or memory, constructive or foresight, and organic or the influence of the mind on the body.

G. V. N. DEARBORN. *The Influence of Joy*. Boston: Little, Brown and Company, 1916. XVIII, 233. \$1.00.

In the past year or two the emotions of anger, grief, suffering, etc., have received a great deal of attention from physiologists. The learned investigations have undoubtedly thrown much light on the mechanism of the emotions, but have given little edification to those who are interested in the practical matter of living. Now comes Professor Dearborn with a monograph on the emotion of joy. This is treated first from a strictly physiological standpoint; then in the second part of the book, from the point of view of the significance of joy in the relations of life. Perhaps the most important chapters are those which discuss the influence of joy on nutrition, on the circulation and on the nervous system.

SANTE DE SANCTIS. *Educazione dei Deficienti*. Milano: Francesco Villardi, 1915. Pp. xviii, 300.

This little book presents the conclusions drawn from the author's sixteen years' experience in dealing with neuropathic and feeble-minded children in the institutions at Rome. There are chapters on the physical and mental development of the feeble-minded, the causes of mental deficiency, the measurement of intelligence, with especial reference to the Binet-Simon scale, the detection of abnormal pupils in school, and a discussion of the various types of schools and pedagogical procedures for the mentally deficient. The book contains much valuable material on the measurement of intelligence.

JOHN DEWEY. *Democracy and Education. An Introduction to the Philosophy of Education.* New York: The Macmillan Company, 1916. Pp. xii, 434. \$1.40.

This is a meaty book and presents not only the latest, but also the most mature and most closely reasoned ideas of the author on the subject of education. The first part of the book is composed of chapters dealing with education from the social, the biological, and the disciplinary points of view. There is a detailed consideration of the doctrine of interest, of which the author is reputed a leading exponent, and an analysis of thinking in its relation to experience and to the method of education. The second part of the book deals with the significance of the various subjects of the curriculum, the values of different types of education, and finally theories of knowledge and of morals. It is a book which calls for careful, reflective study.

EDWARD DICKINSON. *Music and the Higher Education.* New York: Charles Scribner's Sons. 1915. Pp. 234. \$1.50.

The present book is an example of much finer writing than the ordinary volume on an educational topic. Yet in proportion to the balanced phrasing and the elevation of style, one senses a lack of definiteness and constructive guidance. The author writes not because he is anxious to convince anyone, but because ideas well up in his mind and seek to be clothed in artistic, sonorous expression. The three important parts of the book are "The College and the Fine Arts," "Music in the College" and "Teacher and Critic." The latter is a philosophical sketch of the development of music.

JESSIE FIELD AND SCOTT NEARING. *Community Civics.* New York: The Macmillan Company, 1916. Pp. x, 270. 60c.

This book is designed for pupils in rural schools. It directs their attention to the broader aspects of farm life, and fosters the idea of the school as the center of the community.

ROBERT HERNDON FIFE, JR. *The German Empire Between Two Wars. A Study of the Political and Social Development of the Nation Between 1871 and 1914.* New York: The Macmillan Company. 1916. Pp. xiv, 400. \$1.50.

This is a careful, sympathetic, but nonpartisan study of the evolution of the attitude which the German people have in the present war. It is a most interesting and readable book, and presents one of the best pictures of German political, social, and economic life that is to be had.

RALPH D. FLEMMING. *Railroad and Street Transportation.* Cleveland, Ohio: The Cleveland Education Survey, 1916. Pp. 76. 25c.

This volume is an excellent indication of the fact that the schools are no longer to do their work in a vacuum, but it is their function to

assist in preparing their pupils for life service. One of the great industries of Cleveland is railroading, and it is therefore right and proper that this education survey should make a careful study of the railroad and transportation systems that affect the life of the city. Every Cleveland teacher should be expected to be familiar with this little book, and teachers in other cities will find it profitable reading.

ABRAHAM FLEXNER. *A Modern School*. Publications of the General Education Board, Occasional Papers No. 3, 1916. Pp. 23.

The author trenchantly reveals many of the traditional absurdities of present day education, and advocates a curriculum constructed from the four domains of science, industry, aesthetics, and civics. In a few vigorous paragraphs he indicates the gain to be derived from each of these lines of study and shows wherein the traditional emphasis upon mathematics and classics fails to meet the needs of the present day.

FRANK NUGENT FREEMAN. *The Psychology of the Common Branches*. Boston: Houghton Mifflin Company, 1916. Pp. xii, 275. \$1.25.

This is an interesting series of chapters presenting the author's reflections and observations on the teaching of the common branches. The chapters deal with handwriting, drawing, reading, music, spelling, history, geography, mathematics, and natural science. The author does not attempt to give any systematic survey of experimental studies in these fields, but contents himself with a more or less dogmatic statement of his own views, and with occasional illustrative references to experiments. The title is misleading. Far from being a psychological analysis of the activities involved in the study of these subjects, the book seems designed primarily as a teacher's guide. This is indicated by the hortatory tone of almost every section. The author's extended experimental work in psychology and education, and his familiarity with the whole field, result in making him a safe and reliable adviser, but this fact does not make the book a psychology by any means. Each chapter ends with a list of references for further reading. These references are largely to psychological and statistical studies, but the reader will gain little insight into the psychology of school subjects from the author's discussion.

ARTHUR I. GATES. *Diurnal Variations in Memory and Association*. University of California Publications in Psychology. Vol. 1, No. 5, March 3, 1916. Pp. 323-344.

The tests used included auditory memory for digits, visual memory for digits, Whipple's substitution test, a recognition test, and tests in logical memory. "From the early morning the efficiency of the organism begins to increase, culminating in a maximum in the late forenoon followed by a decline immediately after the noon meal,

with a subsequent rise toward the middle of the afternoon, and a final drop in the late afternoon."

ARTHUR I. GATES. *Variations in Efficiency During the Day, together with Practice Effects, Sex Differences, and Correlations*. University of California Publications in Psychology. Vol. 2, No. 1, March 16, 1916. Pp. 1-156.

This monograph presents the results of a series of tests on over one hundred and eighty pupils of the fifth and sixth grades at one hour intervals during the school day. The tests used were addition, multiplication, auditory memory, visual memory, recognition, speed and accuracy of movement, completion, and cancellation tests. There are elaborate tables of correlations for the two sexes and for separate groups, and there is an extended study of variations in efficiency. The highest average correlation is that between multiplication and addition (.72). Other correlations range usually from 0 to .30.

S. MONROE GRAVES. *Report of the School Committee of the Town of Wellesley, Massachusetts, for the Year Ending December 31, 1915*. Pp. 31.

This report contains an age-grade table and an estimate of the cost per pupil in elementary and high schools for the years 1910 to 1915.

CHARLES ELMER HOLLEY. *The Relationship between Persistence in School and Home Conditions*. The Fifteenth Yearbook of the National Society for the Study of Education. Part Two. 1916. Chicago: The University of Chicago Press. Pp. 119. 75c.

"A close correlation is discovered between years of schooling and the economic, social, and educational advantages of the homes from which the pupils come, and these environmental conditions appear to be more important than degree of native ability in determining the amount of schooling. Retardation and truancy are most frequent among the children of poor and uneducated parents. Size of family, however, has no appreciable effect on persistence in school." The monograph contains ninety-one tables, eleven graphs, and eight pages of bibliography on retardation and elimination.

WILLIAM R. HOOD. *Digest of State Laws Relating to Public Education in Force January 1, 1915*. Bulletin 1915, No. 47. Washington: Bureau of Education, 1916. Pp. 987.

The laws are classified under twenty-one rubrics, and under each of these the states are treated alphabetically. An appendix includes state constitutional provisions relating to public education.

BRENELLE HUNT. *A Community Arithmetic*. Cincinnati: The American Book Company, 1916. vii, 277.

This book is frankly informational as well as disciplinary, and is so constructed as to present practical problems from a wide range of industrial and commercial situations. Much of the space is devoted to pictures, diagrams, and other means of presenting these situations.

GEORGE WILLIAM HUNTER. *Laboratory Problems in Civic Biology*. Cincinnati: American Book Company, 1916. Pp. 283.

This is another book in which the problems for the development of the theory are chosen from familiar situations with the evident purpose of furnishing varied information, and, at the same time, developing technique. A feature of the book is the large number of reference books cited at the end of each chapter.

WALTER A. JESSUP. *The Teaching Staff*. Cleveland, Ohio: Cleveland Education Survey, 1916. Pp. 114. 25c.

The salaries paid Cleveland teachers are distinctly lower than in the greater number of American cities of like size. They are also relatively lower than the salaries paid other skilled workers in Cleveland. The author shows how greatly this works to the disadvantage of Cleveland schools in securing and holding their teachers.

EDWIN A. KIRKPATRICK. *Fundamentals of Sociology, with Special Emphasis on Community and Educational Problems*. Boston: Houghton, Mifflin Company, 1916. Pp. x, 291. \$1.25.

There is a distinct need for a simple discussion of the fundamental phenomena of society for high school pupils. Most treatises on sociology are designed for rather advanced college students and are written from the point of view of the social theorist. But it is precisely those high school boys and girls whose formal academic training goes no further than stand in need of a connected survey of social institutions. While the present book was not designed for just this class of students, but rather for normal school and college students, the emphasis upon the biological point of view, the simplicity of treatment, and the limitation of the discussion to aspects of every day life commend the book for use with high school classes.

HENRY C. KREBS. *Reaching the Children. A Book for Teachers and Parents*. New York: A. S. Barnes & Co., 1916. Pp. vi, 127.

A series of talks on the various ways in which the teacher may stimulate and inspire pupils. The book is replete with anecdotes.

R. R. LUTZ. *The Metal Trades*. Cleveland, Ohio: The Cleveland Education Survey, 1916. Pp. 129. 25c.

A study of the metal trades of Cleveland from the point of view of what the schools can and ought to do in the way of preparing their

pupils for the best possible work in this field. The author concludes that there is no need for prevocational school training in the metal trades for the reason that very few boys from the public schools will enter these industries.

ROBERT ALEXANDER FIFE McDONALD. *Adjustment of School Organization to Various Population Groups*. Teachers College Contributions to Education. No. 75. New York: Teachers College, Columbia University, 1915. Pp. v, 145.

The groups considered in this monograph are the deaf, the blind, the delinquent, the dependent and neglected, cripples, the feeble minded, non-English speaking immigrants, the tubercular and anemic, speech defectives, and the exceptionally gifted. The description of various methods of dealing with the latter class is particularly interesting, and should lead to a more careful consideration of the possibilities of special training for the exceptionally gifted.

M. MACLEVY. *The Tobacco Habit Easily Conquered*. New York:

There is more good common sense and sound psychology in this little book than are usually found in the exposition of a "system."

STEWART MACPHERSON. *The Musical Education of the Child*. Boston: The Boston Music Company, 1916. Pp. v, 77. 80c.

What is the function of music in the school and in social life? What can the teacher do to awaken an intelligent appreciation of music and a certain degree of skill in performance? What should be the aims and ideals of the music teacher of today? These are some of the questions discussed in this little book. Unfortunately the author's psychology does not get beyond James's *Talks to Teachers*.

JAMES MAHONEY. *The Advancement of the Teacher with the Class*. Bulletin, 1915, No. 42. Washington: Bureau of Education, 1916. Pp. 81. 10c.

By means of a questionnaire, the author has collected the opinions of superintendents and teachers in regard to the desirability and feasibility of having the teacher progress with the class. The author gives a survey of conditions in foreign schools, and then presents a summary of arguments for and against the plan. The general conclusions are favorable to the plan under proper safeguards.

J. EDWARD MAYMAN. *Teaching Elementary Science in Elementary Schools*. New York: Department of Education, Division of Reference and Research, Publication No. 13, 1915. Pp. 164.

This monograph is an abridgment of the doctor's thesis presented by the author at New York University, the full title of which is "An Experimental Investigation of the Book Method, Lecture Method,

and Experiment Method of Teaching Elementary Science in Elementary Schools." A brief digest of the conclusions are to be found in this JOURNAL, Volume 6, No. 4, April, 1915, Pp. 246-250.

ALBERT A. MERAS AND B. MERAS. *Le Second Livre*. Cincinnati: American Book Company, 1916. Pp. 213.

A series of graded lessons with readings and conversations based upon Jules Verne's "Tour of the World in Eighty Days."

DAYTON CLARENCE MILLER. *The Science of Musical Sounds*. New York: The Macmillan Company, 1916. Pp. viii, 286. \$2.50.

This volume presents the author's Lowell Institute Lectures in 1914. The lectures were originally accompanied by demonstrations, and their place is taken in the book by a very large number of photographs and diagrams. The phases of musical analysis dealt with include the characteristics of tones, methods of recording and photographing sound waves, analysis and synthesis of harmonic curves, errors introduced by horn and diaphragm into sound records, the tone qualities of musical instruments, physical characteristics of the vowels, and the relations of the art and science of music. There is a bibliography of ninety numbers.

FLOYD S. MUCKEY. *The Natural Method of Voice Production in Speech and Sound*. New York: Charles Scribner's Sons, 1915. Pp. xiii, 149.

The earlier chapters of this little book deal with definitions, analysis and classification of facts, pitch, volume, quality, resonance, and interference with the vocal mechanisms. The natural method is one of non-interference, and a series of very simple exercises is indicated which, according to the author, should eliminate this interference almost entirely. There are several interesting photographs of the fluctuations of light induced by the tones of several famous singers.

National Education Association. *Addresses and Proceedipgs*. Oakland, California, 1915. Ann Arbor: Published by the Association, 1916. Pp. xii, 1193.

Of the scores of papers reported in this volume the following are of interest to educational psychologists: Madam Montessori's address before the general Association and the kindergarten section; the discussion of the investigation of the efficiency of schools and school systems, by Van Sickle, Ayres, Kendall, and Maxwell; current methods of dealing with the exceptional pupil, by Baylor, Cooper, Aldrich, Bryan, and Collicott; report of the committee on tests and standards of efficiency, by Blewett, Judd, Maxwell, Phillips, and Strayer; the mental hygiene of exceptional children, by Terman; and the papers presented at the meeting of the department of special education.

G. T. W. PATRICK. *The Psychology of Relaxation*. Boston: Houghton Mifflin Company, 1916. Pp. ix, 280. \$1.25.

The author deals in what he calls strictly scientific fashion with the psychology of play, laughter, profanity, alcohol, and war. In all of these he finds a reaction from the excessive tension of modern life. With play and laughter the relaxation significance is obvious, while both profanity and the use of drugs can easily be shown to have their chief attraction in the feeling of relief from emotional strain. In like manner the author regards war as a kind of katharsis, a reversion to a primitive form of reaction which comes as a relief from too great tension.

RUDOLF PINTNER AND DONALD G. PATERSON. *Learning Tests with Deaf Children*. Psychological Monographs, Vol. 20: No. 4, Whole No. 88, February, 1916. Pp. 57.

One thousand deaf children in three state schools were tested by the digit-symbol and the symbol-digit substitution tests proposed by Whipple and used on normal children by Pyle. The authors conclude that the deaf child is about three years behind the hearing child in learning ability, and that the congenitally deaf and the adventitiously deaf are equally retarded.

EDWIN W. ROESSLER AND ALFRED REMY. *A First Spanish Reader, with Questions and Vocabulary*. Cincinnati: The American Book Company, 1916. Pp. 248.

This reader is arranged on a sort of radial or spiral plan, beginning with the immediate environment of the pupil and ranging outward to more remote and complicated situations.

FRANK L. SHAW. *The Building Trades*. Cleveland: Cleveland Education Survey, 1916. Pp. 107. 25c.

The author thinks that vocational training for the building trades should be started not later than the seventh grade. The junior high school affords an excellent opportunity for differentiation of work, and for such an arrangement of the curriculum as to offer the constructional geometry, elementary science and mechanical drawing needed in these trades so that boys will get them early in the course.

FRANK L. SHAW. *The Printing Trades*. Cleveland: Cleveland Education Survey, 1916. Pp. 95. 25c.

These trades are so highly differentiated that training in one branch is of little or no value in another. This high degree of specialization and the fact that only a very small per cent. of school boys go into any phase of the printing industry make it inadvisable to attempt special training in school. A general shop course is recommended.

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MENTAL TESTS AND COLLEGE FRESHMEN

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INTRODUCTION

The investigation described in this article was undertaken in the hope that the use of mental tests might be of assistance to college authorities in aiding freshmen to adjust themselves to their environment. While it is true that previous efforts of this sort have not been very successful, it was thought worth while to try a new combination of tests.

The first physical and mental measurements of freshmen were taken by Cattell (3) at Columbia College in 1896. The data accumulated in these tests were discussed by Wissler (12) in 1901, and the degree of connection between them was expressed in terms of Pearson coefficients of correlation. Wissler also took account of the class standing of these students. Table I gives some of the more pertinent correlations. The number of scores entering each correlation varied from 90 to 252.

It will be seen from the table that the correlation between marks in college subjects is fairly high (.50 to .60) but the correlations of class standing with tests or of the tests with each other are very low. This may be due to the fact that the traits measured have very little inherent connection with each other, or that the tests and the methods of giving them were such as to obscure the relationships that exist, or finally that the group is so nearly homogeneous that the variations in the test results are chiefly due to chance. It is interesting to note that the highest correla-

TABLE I

Wissler's Coefficients of Correlation

Reaction time—Cancellation of A's.....	— .05
Reaction time—Naming colors.....	.15
Reaction time—Association time.....	.08
Reaction time—Movement time.....	.14
Naming colors—Cancellation of A's.....	.21
Naming colors—Movement time.....	.19
Drawing line—Bisecting line.....	.38
Accuracy—Speed in cancellation of A's.....	— .28
Auditory memory—Visual memory (correctly written).....	.29
Auditory memory—Visual memory (correctly placed).....	.39
Auditory memory—Logical memory (correctly written).....	.05
Auditory memory—Logical memory (correctly placed).....	.04
Logical memory—Retrospective memory.....	— .07
Force of movement—Drawing line.....	— .08
Logical memory—Naming colors.....	.03
Logical memory—Reaction time.....	.12
Auditory memory—Reaction time.....	.17
Visual memory—Reaction time.....	.06
Pitch memory—Reaction time.....	.01
Class standing—Reaction time.....	— .02
Class standing—Cancellation of A's.....	— .09
Class standing—Association time.....	.08
Class standing—Naming colors.....	.02
Class standing—Logical memory.....	.19
Class standing—Auditory memory.....	.16
Class standing—Gymnasium.....	.58
Latin—Mathematics.....	.58
Latin—Rhetoric.....	.55
Latin—French.....	.60
Latin—German.....	.61
Latin—Greek.....	.75
Rhetoric—French.....	.30
Rhetoric—German.....	.61
Rhetoric—Mathematics.....	.51
Gymnasium—Mathematics.....	.52
Mathematics—Logical memory.....	.11
Latin—Logical memory.....	.22

TABLE II

Waugh's Coefficients of Correlation

Class standing—Quickness of association (opposites).....	.54
Class standing—Speed of learning (substitution).....	.24
Class standing—Range of information.....	.47
Class standing—Retention of ideas.....	.40
Class standing—Steadiness of hand.....	— .43
Range of information—Quickness of association.....	.32
Range of information—Steadiness of hand.....	— .20
Ingenuity (puzzle box)—Speed of learning.....	.51
Ingenuity (puzzle box)—Steadiness of hand.....	— .22

tion is between Latin and Greek (.75), and that class standing correlates more highly with logical memory (.19) than with any other test. The correlation between drawing a line equal to a given line and bisecting a given line (.38) is what we might expect, since the two attitudes are so nearly alike. The close relationship between visual and auditory memory (.39) is not surprising.

At the meeting of the American Psychological Association in Chicago, December, 1916, Waugh (11) read a paper on "A new Mental Diagnosis of College Students," a newspaper abstract of which is available. In 1912 Waugh gave the following mental tests individually to freshmen in Beloit College: (1) Concentration of attention (cancellation of A's); (2) range of information (Whipple list); (3) speed of learning (substitution tests); (4) quickness of association (opposites); (5) ingenuity (puzzle box); (6) steadiness of hand at rest; and (7) memory for a passage (immediately after reading and after a lapse of two weeks). Pearson coefficients of correlation are indicated in Table II.

All of these correlations are considerably higher than those obtained by Wissler, but whether it is on account of the difference in tests or a difference in method is impossible to say. Three years later the same tests were given to as many of the same students as remained in college. No correlations are indicated, but the statement is made that as seniors the students had improved 4.6 per cent. in concentration of attention, 4.2 per cent. in speed of learning, 2 per cent. in quickness of association, 44.7 per cent. in range of information, and 19 per cent. in class standing.

Bingham (1) gave the following nine tests individually to 200 Dartmouth freshmen: (1) Endurance of grip; (2) tapping; (3) auditory memory; (4) memory for a passage; (5) cancellation of a given digit; (6) color naming; (7) logical relations; (8) mixed relations (analogies); and (9) perception of form. No correlations are indicated, but the results are presented in "ogive" percentile graphs, so that it will be easy to compare the results obtained from other individuals with those already plotted.

Hollingsworth (5), working with 13 students in the psychological laboratory, found that correlations between tests became much higher as the subjects approached the limits of improvement with practice. Table III shows the correlations at the extremes of practice.

TABLE III

Effect of Practice on Correlations

	Trial	Tap- ping	Coördin- ation	Discrim- ination	Color Naming	Op- posites	Average
Adding	1	.45	— .21	.23	.26	.23	.19
	205	.57	.16	.15	.76	.76	.48
Opposites	1	.36	— .14	— .46	.53		.10
	205	.55	.50	.39	.88		.62
Color Naming	1	.36	— .28	— .13			.15
	205	.52	.47	.41			.61
Discrimination	1	— .08	.11				— .07
	205	.59	.19				.35
Coördination	1	— .25					— .15
	205	.39					.34
Tapping	1						.17
	205						.52

In the course of a study of variations in efficiency during the day Gates (4) found that the correlations between nine mental tests with 172 pupils of grades VI, VII and VIII showed a tendency to be low. The results are seen in Table IV.

TABLE IV

Tests of School Children

	Multiplication	Addition	Speed of M'v't	Acc. of M'v't	Completion	Cancellation	Aud. Mem.	Vis. Mem.	Recognition
Multiplication		.72	.03	.04	.11	.20	— .01	— .07	.04
Addition			.01	.07	.07	.24	— .06	— .13	— .07
Speed of M'v't				— .76	.21	.29	— .06	.09	.03
Acc. of M'v't					— .07	.17	.09	.08	.14
Completion						.15	.14	.18	.17
Cancellation							.03	.04	.09
Aud. Mem.								.57	.17
Vis. Mem.									.11
All Tests	.13	.12	— .02	— .07	.12	.11	.10	.11	.10

The only high correlations are multiplication with addition, visual with auditory memory, and a negative correlation of speed with accuracy of movement. It is noteworthy that cancellation has a considerable correlation with multiplication, addition and speed of movement, all three involving activities in some degree common to cancellation.

Starch (8) in a study of the school marks of children in grades V, VI, VII and VIII found some remarkably high correlations, as shown in Table V. In another computation, which he thinks is more reliable, he obtained even higher correlations for some of the subjects. Perhaps the correlations of school marks are higher for elementary school pupils because teachers know more about the pupils outside of their work in the special subjects than do teachers of higher classes, and therefore are governed more by general principles in their marking. This would tend to produce greater uniformity, and, therefore, higher correlations.

TABLE V
Correlations of School Marks

	Arithmetic	Language	Geography	History	Reading	Spelling
Arithmetic		.73	.74	.73	.45	.42
Language	.73		.86	.77	.80	.77
Geography	.74	.86		.81	.83	.68
History	.73	.77	.81		.67	.37
Reading	.45	.80	.83	.67		.72
Spelling	.42	.77	.68	.37	.72	

Simpson (6) chose two groups of individuals differing as widely as possible in intellectual status, and applied the same series of tests to determine what ones gave the clearest indication of this difference in mentality. His "good" group was composed of seventeen professors and advanced students in Columbia University. His "poor" group contained twenty adults found in the Salvation Army Industrial Home, a Bowery mission and other refuges for human misfits. None of the "poor group" had ever held positions requiring a high grade of intelligence. His raw correlations are shown in Table VI.

These raw correlations are for both groups together, and are considerably higher than those for each group taken separately. In the one case the deviations are taken from the median of the entire thirty-seven individuals, and since the groups were chosen to represent extremes the deviations are naturally quite marked and fairly uniform. In the other case the deviations are computed from the median of each group separately, and therefore are by no means so uniform. In order to determine what the probable true correlations would be if a very large group representing a normal distribution of human minds were taken instead of two small selected groups, Simpson has worked out elaborate

TABLE VI

Simpson's Raw Correlations

	Ebbinghaus	Hard Opp.	Mem. of Words	Easy Opp.	Canc. of A's	Mem. of Pass.	Adding	Geom. Forms	Learn. Pairs	Rec. Forms	Scroll	Compl. Words	Est. Lengths	Draw. Lengths
Ebbinghaus		.98	.94	.79	.62	.91	.71	.54	.78	.88	.55	.42	.33	.25
Hard Opp.	.98		.84	.80	.64	.81	.79	.70	.73	.74	.52	.43	.26	.25
Mem. of Words	.94	.84		.62	.55	.82	.49	.56	.73	.71	.53	.40	.28	.21
Easy Opp.	.79	.80	.62		.57	.52	.68	.53	.42	.56	.45	.29	.38	.48
Canc. of A's	.62	.64	.55	.57		.55	.54	.73	.39	.51	.39	.59	.25	.22
Mem. of Pass.	.91	.81	.82	.52	.55		.53	.57	.59	.66	.54	.31	.28	.19
Adding	.71	.79	.49	.68	.54	.53		.45	.39	.47	.51	.57	.17	.25
Geom. Forms	.54	.70	.56	.53	.73	.57	.45		.35	.49	.54	.56	.25	.25
Learn. Pairs	.78	.73	.73	.42	.39	.59	.39	.35		.69	.36	.29	.26	.09
Rec. Forms	.88	.74	.71	.56	.51	.66	.47	.49	.69		.44	.37	.34	.28
Scroll	.55	.52	.53	.45	.39	.54	.51	.34	.36	.44		.31	.19	.27
Compl. Words	.42	.43	.40	.29	.59	.31	.57	.56	.29	.37	.31		.21	.07
Est. Lengths	.33	.26	.28	.38	.25	.28	.17	.25	.26	.34	.19	.21		.24
Draw. Lengths	.25	.25	.21	.48	.22	.19	.25	.25	.09	.28	.27	.07	.24	

computations of "correction for attenuation" in which the highest correlations are reduced from .10 to .20 below those given in the table. Even so, however, most of the correlations remain remarkably high, and in this respect show little agreement with the results of the present study.

In his vice-presidential address before Section L (Education), American Association for the Advancement of Science, in December, 1912, Thorndike (10) took as his subject "Educational Diagnosis." He discussed Simpson's work in some detail and proposed the following eight tests for determining intellectual status: (1) Completion; (2) opposites; (3) learning pairs; (4) recognition of forms; (5) marking false statements; (6) addition; (7) following directions; and (8) selective judgment, or selecting valid reasons for a fact.

"From the combined score made by an individual in these eight tests his general intellectual ability—his capacity, that is, for science, scholarship, and the management of ideas of all sorts—could be prophesied with a surprisingly small error . . . If each of us knew all in the company well and wrote down the names in an order of general intellectual ability, and if all of these orders were combined into an order representing the impartial judgment of the total group about each of its members, this order

would be hardly any truer than the order got by using the combined scores of the tests alone. The two orders would indeed be practically identical. There is excellent reason to believe that it is literally true that the result of two hours' tests properly chosen from those already tested gives a better diagnosis of an educated adult's general intellectual ability than the result of the judgments of two teachers or friends who have observed him in the ordinary course of life each for a thousand hours."

This address furnished the starting point for the present investigation. The question was raised, "Could these tests be used in any way to throw light on the differences in intellectual capacity among the seven hundred and more freshmen at the University of Texas?" It was out of the question to devote two hours to each student individually for the application of the tests, and while it was realized that the modification of the tests for use as mass tests might rob them of all their diagnostic value, it was thought worth while to make the attempt. After a considerable amount of preliminary experimentation nine tests were selected for use. It was decided to proceed on the principle of amount of work done within a given time limit, and the time was so chosen that even the most rapid workers were scarcely able to finish the test. The attitude induced in the students, therefore, was throughout that of the speed test.

THE METHOD OF GIVING THE TESTS

The nine test blanks were fastened together into bundles with clips, and each student was provided with a bundle, placed face down on the desk. The students were asked not to look at any of the tests until told to do so. The tests were as follows:

(1) Cancellation of triangles. (For a reproduction of this test sheet see Simpson 6, p. 113, A.) The test sheet contained 50 triangles distributed irregularly among a large number of other geometrical figures arranged in sixteen rows. At a given signal the students were instructed to turn the sheet and to cross out triangles as rapidly as possible for one minute. They were cautioned not to omit any triangles, and not to cross out any other figures. The wording of the instructions for this and all of the tests was carefully worked out beforehand, and a type-written copy given to each examiner with the injunction to use exactly those words and no others.

(2) Addition. (See Simpson, 6, p. 117, XIa.) Time allowed, one minute.

(3) Association. (See Thorndike, 10, p. 138, fig. 1, or Simpson, 6, p. 116, fig. 2. The words and groups of lines used were slightly different from any of those represented.) This test is called "Learning Pairs" by Simpson and Thorndike. The "study sheet" contained ten groups of short, straight lines, each followed by a familiar word. At a given signal this sheet was turned and the students were given two minutes to study it in order to fix the associations between the characters and the words. They had been told beforehand that at the expiration of the time they would turn up another sheet on which they would find the same characters in a different order, and they would be expected to write after each character the word that was associated with it. Two minutes were allowed for this writing.

(4) Recognition. (See Simpson, 6, p. 113, E, F.) This is Simpson's Recognizing Forms test. The students were told that they would turn up a sheet on which there were twenty-five different forms. They would be given three minutes to study these forms, fixing them in mind so that they would be recognized anywhere. Particular attention was to be paid to the position of the forms on the page, for some of them differed from others only in the way they were placed on the page. At the expiration of the time they were to lay this sheet face down and turn up another sheet on which they would find the same forms mixed with twenty-five others. They were asked to draw a vertical line through each form recognized from the first sheet. Two minutes were allowed for the marking.

(5) Selective Judgment. (See Bonser, 2, p. 5, VA.) Ten reasons are given in answer to the question, "Why has New York become a larger city than Boston?" Three of these reasons are valid. The student was asked to place a check mark before each reason which he thought valid. Each student was allowed to finish checking the list, and as he worked the examiner wrote on the board the digits 1, 2, 3, 4, 5, 6, etc., at intervals of five seconds. As the student finished he glanced at the board and put on his paper the last digit he saw there. This digit multiplied by five gave the number of seconds spent on the test. In making up the score, however, it was found that the time had very little significance, and it was therefore ignored.

(6) Directions, No. 1. (See Woodworth and Wells, 13.) This test consisted of both the Woodworth and Wells easy lists of "Following Directions" combined on a single sheet, making forty tasks to perform. The time allowed was one minute.

(7) Directions, No. 2. (See Woodworth and Wells, 13.) This was Woodworth and Wells' hard list. The time limit was one minute.

(8) Alternatives. (See Squire, 7, p. 493.) This consisted of fifteen sentences of the following type:

Days are ^{longer}_{shorter} in summer than in winter.

The students were instructed to cross out one of the two words, leaving the statement correct. Forty-five seconds were allowed.

(9) Completion. (See Terman and Childs, 9, p. 198.) This was the Terman form of the well known completion test, "The Strength of the Eagle." Five minutes were allowed.

It will be seen that the net working time for the whole series of tests was twenty minutes. Allowing time for the distribution of the test papers, the general explanation of the tests, the detailed directions for each test, the answering of questions (which were always welcomed before the test began, but positively forbidden after the signal to start had been given), and the collection of papers, the time required was usually from forty to forty-five minutes. This so distributed the efforts of the students that little fatigue was noticed. The tests were given in November, 1913, to approximately seven hundred and fifty freshmen at the University of Texas, in groups averaging a little less than twenty each.¹

SCORING THE RESULTS

The results were first scored on thirteen large sheets of cross section paper, the scores for each student running on the same line entirely across the page. In test No. 1 (Triangles) a column was devoted to the number of triangles crossed out, another to the number of other figures wrongly crossed (positive errors), and a third to the number of triangles omitted (negative errors). The number of positive errors was very small, but the great majority

¹ The author gratefully acknowledges the assistance in giving the tests of Professors C. S. Yoakum, A. C. Ellis, L. W. Sackett, Dr. C. T. Gray and Messrs. E. D. Jennings and D. F. McCollum, graduate students. The author is also greatly indebted to Miss Lucille M. Rawlins, M. A., for valuable help in the computation of coefficients of correlation.

of students made one or more negative errors. Test No. 2 (Addition) consisted of ten problems of two columns each. A column was set aside on the score sheet for each column to be added, and errors were indicated by check marks in the appropriate columns. A vertical line indicated the last addition attempted, and in a final column was indicated the total number of columns correctly added. In test No. 3 (Association) a column was devoted to each association, and each wrong association was scored as a positive error (+), while each omission of a word (lack of association) was scored as a negative error (—). A final column showed the total number of correct associations.

In test No. 4 (Recognition) each of the fifty figures on the second or recognition sheet was given a column. If the figure was correctly marked a check mark was placed in the column. If it was marked when it should have been left blank (false recognition), a + mark was placed in the column and it was called a positive error. If it was unmarked when it should have been marked (lack of recognition), a — mark was placed in the column and it was called a negative error. If it was correctly left unmarked, the space was left blank. Final columns showed the score (the number correctly marked), the number of positive errors and the number of negative errors.

In test No. 5 (Selective Judgment) a column was given to each of the ten reasons assigned. The significant reasons were numbers 3, 6, and 8. These were checked if correctly marked. If other reasons were marked they were called positive errors and + marks were placed in the appropriate columns. If any of the three significant reasons was not marked, it was called a negative error and a — mark was placed in the proper column. Final columns indicated the number of positive errors and the number of negative errors.

In tests No. 6 (Directions No. 1), No. 7 (Directions No. 2), and No. 8 (Alternatives) a column was set aside for each task, a check mark was made in it if the task was wrongly performed, and a vertical line showed the last task attempted. Final columns showed the scores and the number of errors in each case.

In test No. 9 (Completion) no attempt was made to use the system of weightings indicated by Terman, but each completion that did not satisfy the sense of the passage was struck out and called a positive error, blanks that had not been filled were noted

and called negative errors, and the number of the last blank attempted was taken as the score of the rate of completion. The score sheet thus showed the number of completions attempted, the number of positive errors, and the number of negative errors. The author has preserved this material, and expects to make a more detailed study of the results of this test.

REDUCTION TO SINGLE MEASURES

For purposes of comparison and correlation it was desirable to reduce the results obtained from each test to a single numerical score. In doing this an effort was made to arrive at such a scheme of weighting for each test that a perfect mark, or the highest mark, as the case might be, would approximate 100, and other marks range downward from this to 0. In test No. 1 (Triangles), since there was a total of fifty triangles, two was taken as the constant multiplier for the number of triangles crossed out, and five points were deducted for each error, positive or negative. For example, if a student crossed out 35 triangles, omitted three, and crossed out one circle, his score was $70 - 20 = 50$.

In test No. 2 (Addition) there were twenty columns, and on the basis of 100 each column would be worth five points. It was thought that the errors were sufficiently penalized by the reduction of the score, and the final score taken was thus five times the number of columns correctly added. In test No. 3 (Associations) both positive and negative errors were ignored, and the score taken was ten times the number of correct associations. In test No. 4 (Recognition) there were twenty-five forms to be recognized and marked. The negative errors were sufficiently penalized by their failure to increase the score, so the final score was taken as four times the number of forms correctly marked, while a positive error of false recognition was penalized by deducting three points. Thus the score of a student who had fifteen forms correct and two wrong would be 54, while that of one who had twenty forms correct and ten wrong would be 50.

In test No. 5 (Selective Judgment) each student was given 100 to start with, 15 was deducted for each positive error, and 10 for each negative error. While test No. 6 (Directions No. 1) contained forty chances, an inspection of the raw scores showed that very rarely did a student attempt as many as twenty-five in the time allowed. Therefore the final score chosen was four times

the number attempted, and since the tasks were so very simple it was thought that the deduction of ten for every error would be none too heavy a penalty. Test No. 7 (Directions No. 2) offers twenty-one chances, but no one finished in the time allowed, so the score chosen was five times the number attempted minus ten times the number of errors. Test No. 8 (Alternatives) has fifteen tasks, which makes the nearest even multiplier seven. Ten were deducted for each error. In test No. 9 (Completion) there were 107 spaces to be completed, but only three or four students finished the entire paper in the time allowed, and each of these made several errors, so it was decided to assign a score of one for each space as far as the student went, and to deduct two for each positive error and one for each negative error.

It is frankly admitted that these weightings are arbitrary, but they were arrived at after prolonged trials with different kinds of weighting, and comparison of individual scores with each other on the basis of these weightings shows that they give a just measure of the relative performance of the students in the tests. In a very few instances the scores in tests 6-9 ran slightly over 100. In that case they were arbitrarily called 100. In perhaps ten or fifteen very low scores the method of penalizing adopted made the final score a negative quantity. In these cases it was arbitrarily called 0.

UNIVERSITY GRADES

In addition to the results of the tests the university grades for each student were recorded. At the University of Texas a grade is entered on the records of the Registrar for each term's work of twelve weeks, giving three grades for the year in a full course. The system of marking in use is the letter system, A, B, C, D, E, and F, with D as the passing mark. These letters were given the following numerical values: A=90; B=80; C=70; D=60; E and F=50, and the average numerical mark for the year in each of six groups of subjects was determined. The only subject taken by all the students tested was English. For the purposes of this study the subjects taken by freshmen were divided into six groups, as follows: English, mathematics, history, science (physics, chemistry, botany, zoölogy, geology), foreign languages (Latin, Spanish, French, German), and education. Table VII indicates the percentile scores of the freshmen in the six university subjects and the nine mental tests.

TABLE VII
Percentile Scores of University Freshmen

	English	Mathematics	History	Science	For. Lang.	Education	Triangles	Addition	Association	Recognition	Select. Judg.	Dir. No. 1	Dir. No. 2	Alternatives	Completion
No. of Students	702	506	359	546	544	129	712	709	709	730	730	746	746	729	726
Lowest Score	50	50	50	50	50	50	0	0	0	0	0	4	0	2	0
10 per cent.	53	52	52	54	52	60	36	32	39	25	26	40	26	38	19
20 per cent.	57	54	55	60	54	64	45	40	48	33	42	47	34	48	25
30 per cent.	61	58	60	53	58	68	51	45	55	39	48	53	41	54	31
40 per cent.	63	62	62	66	62	71	55	50	62	43	53	58	45	60	35
50 per cent.	65	64	64	69	65	72	58	55	69	47	57	62	50	65	39
60 per cent.	68	68	68	72	69	74	62	60	75	51	66	66	54	69	44
70 per cent.	71	71	71	74	73	76	65	66	82	56	74	70	59	74	48
80 per cent.	74	74	74	78	78	80	69	72	91	60	78	77	67	78	54
90 per cent.	86	84	80	82	85	83	76	82	100	67	86	87	75	86	60
Highest Score	90	90	90	90	90	90	95	100	100	96	100	100	100	100	94

Examination of Table VII shows that English, mathematics, and history, despite the difference in number of students, have their grades distributed in about the same fashion from lowest to highest, *i. e.*, the different percentile groups have about the same grade boundaries. Foreign languages also have practically the same distribution below the median, but their better-class students receive relatively higher grades than those in the other groups, although it is noteworthy that the upper ten per cent. of students in mathematics are better favored than those in either English or history. The sciences start their grading higher than any of the subjects already considered, and maintain their lead as far up as the eighty percentile group, where they are overtaken by foreign languages. Education shows a much higher appreciation of its low grade students than any of the other subjects, maintaining a striking lead as far as the eighty percentile. Its better students, however, do not get as high marks as those in mathematics or foreign languages.

Turning our attention now to the tests, we are impressed at once by the strikingly high scores in Association, and the equally low ones in Completion. The Association test was obviously the easiest of all the tests. The lowest ten per cent. did better with it than any other test except Directions No. 1, and the other percentile groups increased their lead until in the best ten per cent. all

made a perfect score. Precisely seventy-one out of a total of 709 made a score of 100. In the Completion test, on the other hand, the scores start low, the median is eight points lower than in any other test, and the upper percentiles are relatively low. This was due partly to the weighting employed, but also to the fact that the test itself was found distinctly difficult. Another difficult test, the scores of which are only slightly higher than those of the Completion test, is the Recognition test. The most evenly balanced of all the tests so far as the percentile groups are concerned is Directions, No. 2. The median score is just 50, and the percentile groups are distributed with remarkable regularity below and above it.

Table VIII presents the Pearson coefficients of correlation of university marks with each other, of marks with test scores, and of test scores with each other. These were determined by the formula

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2} \sqrt{\Sigma y^2}}$$

It will be seen that the correlations between university marks are fairly high, ranging from mathematics-history=.34 to English-history and science-history=.59. Why marks in science should correlate so highly with those in history is not clear. Foreign languages have the highest average correlation with other subjects (.542) and mathematics the lowest (.484). The correlations of university marks with test scores are uniformly low, the highest being English-Completion=.31. Triangles and Selective Judgment have practically no correlation with any university marks, and the other tests show a considerable variation. The relatively high correlation of English with the two Directions and the Alternatives tests is interesting, as is also that between Addition and mathematics, science and foreign languages.

Considering the relations of the test scores to each other, one is immediately impressed by the connections between the two sets of Directions, the Alternatives and the Completion test. This is the only group of relatively high correlations that exists among the tests, if we except the Association-Recognition relationship (.30) in which there is a high degree of identity in procedure. Perhaps the connection between these four tests is due to the linguistic factor which is present in all of them. The ability to

TABLE VIII
Coefficients of Correlation, University Freshmen

	English	Mathematics	History	Science	For. Lang.	Education	Triangles	Addition	Association	Recognition	Select. Judg.	Dir. No. 1	Dir. No. 2	Alternatives	Completion
English		.46	.59	.45	.58	.44	.01	.11	.20	.17	.00	.26	.27	.24	.31
Mathematics	.46		.34	.57	.52	.53	.13	.23	.16	.14	.07	.13	.12	.18	.22
History	.59	.34		.59	.56	.43	.00	.13	.12	.18	.06	.19	.06	.15	.16
Science	.45	.57	.59		.49	.48	.04	.25	.12	.19	.06	.12	.15	.13	.17
For. Lang.	.58	.52	.56	.49		.56	-.03	.25	.15	.14	.06	.19	.18	.11	.20
Education	.44	.53	.43	.48	.56		.02	.12	.02	-.08	.04	.03	.04	.25	.16
Triangles	.01	.13	.00	.04	-.03	.02		.10	.13	.08	.02	.12	.10	.21	.14
Addition	.11	.23	.13	.25	.25	.12	.10		.07	.06	.09	.14	.15	.20	.12
Association	.20	.16	.12	.12	.15	.02	.13	.07		.30	.05	.14	.11	.14	.21
Recognition	.17	.14	.18	.19	.14	-.08	.08	.06	.30		.03	.17	.17	.13	.15
Select Judg.	.00	.07	.06	.06	.06	.04	.02	.09	.05	.03		.01	-.04	.06	.09
Dir. No. 1	.26	.13	.19	.12	.19	.03	.12	.14	.14	.17	.01		.33	.34	.36
Dir. No. 2	.27	.12	.06	.15	.18	.04	.10	.15	.11	.17	-.04	.33		.23	.30
Alternatives	.24	.18	.15	.13	.11	.25	.21	.20	.14	.13	.06	.34	.23		.29
Completion	.31	.22	.16	.17	.20	.16	.14	.12	.21	.15	.09	.36	.30	.29	

quickly sense the meaning of the printed words and perform the simple task that is required is the thing that contributes to a high score in any one of these tests. In so far then we would seem justified in assuming a more or less general "linguistic sense" or skill in dealing with linguistic problems, which is involved in all four of these tests, and which also contributes largely to success in college classes.

On the other hand the Selective Judgment and Triangles tests have practically no correlation with any of the tests or college subjects. If we compute the average correlation of each test with all the others and arrange them in descending order we have the following array: (1) Completion, .206; (2) Alternatives, .190; (3) Directions, No. 1, .181; (4) Directions, No. 2, .155; (5) Addition, .144; (6) Association, .137; (7) Recognition, .131; (8) Triangles, .076; (9) Selective Judgment, .043.

SCORES OF BEST AND POOREST STUDENTS

In a study of the individual scores for contrasts in results it was noted that thirty-seven students had an average class standing of 80 or higher, and that precisely the same number had an average class standing of 52 or lower. The individual scores for these two

TABLE IX
Scores of Best Students

	Av. Class Standing	Triangles	Addition	Association	Recognition	Select. Judg.	Dir. No. 1	Dir. No. 2	Alternatives	Completion	Total
Medians		58	55	69	47	57	62	50	65	39	502
1. Litsey, Mary	88	71	55	100	44	100	100	75	78	69	692
2. Davis, M.	88	60	60	90	75	80	92	60	77	49	643
3. Masters, Mildred	88	65	80	70	57	25	100	75	61	76	609
4. Trice, L.	88	62	60	100	53	85	92	55	49	59	605
5. Ware, L.	88	66	55	60	39	55	70	65	78	42	530
6. August, Maxie	87	64	95	60	27	40	72	55	53	40	506
7. Lewin, B. D.	86	65	80	50	66	80	100	75	88	89	693
8. Shelton, E.	85	76	80	70	36	100	18	65	100	92	637
9. Wynn, F.	85	64	45	100	85	55	76	45	60	73	603
10. Riley, M.	85	46	40	70	40	75	68	55	70	50	514
11. Wood, O. J.	85	45	100	60	41	30	62	35	65	0	438
12. Sweet, M.	84	76	55	80	96	55	58	85	77	93	675
13. Osborne, E.	84	64	65	100	84	40	66	75	81	57	632
14. Higdon, J. E.	84	66	55	50	66	85	100	35	85	48	590
15. Earhart, J.	84	64	65	80	56	40	54	55	36	52	502
16. Beckmann, W.	84	50	45	70	35	55	52	60	67	44	478
17. Wilmeth, R. D.	83	60	45	100	65	40	62	55	60	41	523
18. Girard, F.	83	0	70	60	26	50	75	55	50	50	437
19. Nagle, R.	82	53	55	90	73	70	94	40	78	66	619
20. Baker, E.	82	47	75	80	59	100	80	40	60	54	595
21. Snyder, Roy	82	62	70	80	71	40	40	50	36	55	504
22. Warren, W.	82	22	65	50	46	55	56	50	39	25	408
23. Rawalt, N.	81	72	60	100	64	55	100	50	98	48	647
24. Bagnall, B.	81	55	50	100	73	70	80	75	100	26	629
25. Blair, W. C.	81	69	80	100	52	55	64	65	50	56	591
26. Harrold, C.	81	72	40	100	63	55	46	65	91	43	575
27. Lorelare, M.	81	32	70	80	56	50	72	40	50	55	505
28. Brand, C. E.	81	38	55	80	44	55	58	45	47	48	470
29. Burt, Helen	81	55	50	40	26	5	40	45	88	37	386
30. Fish, J. W.	80	76	75	100	57	85	56	55	71	50	625
31. Atkinson, J. B.	80	57	50	100	80	70	76	55	44	57	589
32. Lockett, H. S.	80	45	70	60	64	45	72	70	63	55	544
33. Cunningham, C.	80	62	55	60	58	55	80	60	71	42	543
34. Nelson, M.	80	54	75	70	38	20	96	60	48	55	516
35. Mobley, Helen	80	60	45	60	39	85	76	25	84	20	494
36. Shelmire, B.	80	43	40	70	56	70	54	10	64	54	461
37. Baker, Lois	80	0	45	60	40	70	52	45	74	32	418
Number of scores above median		22	19	25	23	15	23	23	19	31	27

TABLE X
Scores of Poorest Students

	Av. Class Standing	Triangles	Addition	Association	Recognition	Select. Judg.	Dir. No. 1.	Dir. No. 2	Alternatives	Completion	Total
Medians		58	55	69	47	57	62	50	65	39	502
1. Hopkins, H. R.	52	76	60	100	32	85	64	50	77	48	592
2. Givens, M.	52	52	90	70	54	85	60	35	40	44	530
3. McGregor, R.	52	59	60	50	50	55	84	50	77	45	530
4. Crow, F. A.	52	72	65	20	64	55	56	75	67	44	518
5. Skiles, S. A.	52	73	65	80	32	40	72	60	47	33	502
6. Christoffer, O. T.	52	76	75	40	49	45	38	40	84	48	494
7. Chambers, F. E.	52	77	50	69	41	30	100	10	70	23	470
8. Cleveland, C. R.	52	62	30	30	43	85	56	65	60	29	460
9. McKnight, C. B.	52	80	50	60	42	40	66	50	22	45	455
10. Gaudy, W. S.	52	58	55	70	41	70	38	30	50	31	443
11. Davidson, J. T.	52	0	50	90	36	85	56	10	60	50	437
12. Martin, Floss	52	60	30	40	59	75	44	45	32	49	434
13. Dickey, W.	52	48	30	20	49	55	56	55	70	51	434
14. Clifton, Carrie	52	56	55	50	38	70	80	10	70	0	429
15. Lang, M. A.	52	78	50	70	47	10	50	40	60	13	418
16. Simpson, S.	52	64	30	50	50	60	34	40	30	32	390
17. Porcher, S.	52	56	35	20	48	40	44	40	70	29	382
18. Dyer, Earl	52	22	35	80	34	40	48	15	53	48	375
19. Harlen, H. L.	52	66	50	70	39	10	26	25	60	27	373
20. Sutherland, G.	52	18	55	20	41	55	80	45	40	12	366
21. Coats, R. H.	52	38	30	10	55	25	44	25	56	5	288
22. Williams, Horace	51	0	25	40	42	55	84	30	70	28	374
23. Soule, D. F.	51	58	25	69	19	40	16	15	16	31	289
24. McCambell, C. A.	50	41	80	50	40	85	70	40	70	40	516
25. Creaton, L. B.	50	60	35	100	46	85	56	40	63	27	512
26. Terhune, S.	50	80	65	100	24	30	72	45	49	26	491
27. Lindsey, George	50	31	45	70	62	70	46	50	53	59	486
28. June, E.	50	61	70	80	38	25	56	20	64	50	464
29. Floyd, J.	50	63	90	40	63	45	44	55	30	28	458
30. Maxon, W.	50	86	25	70	57	40	44	55	50	29	456
31. Stiles, Eudora	50	13	60	90	24	70	50	60	56	33	456
32. Graves, L.	50	62	60	30	40	55	48	70	47	29	441
33. Thompson, P.	50	64	25	70	44	70	44	35	47	25	424
34. Farley, R. H.	50	16	55	80	35	55	52	35	43	26	397
35. Hutchins, W. M.	50	60	40	40	66	45	28	30	33	33	375
36. Marshall, L. B.	50	60	35	0	40	70	60	35	36	32	368
37. Heard, Thos.	50	65	30	40	55	0	48	35	22	45	340
Number of scores below median		13	21	19	22	23	27	25	27	23	30

groups of students are found in Tables IX and X. The average of the total scores for the group of the best students was 563, or 61 points above the median for all students. The highest was 693, the lowest 386. For the group of poorest students the average was 438, or 64 points below the median, the highest was 592, and the lowest 288. In the best group the number of scores above the median is especially high in the Completion test, and is fairly high in the totals, the Association, Recognition, both Directions, and the Triangles tests. In the poorest group the number of scores below the median is striking in the totals, and in the Alternatives, the two Directions, the Completion, and the Selective Judgment tests. It is possible that the chief element of difference here, as in the university work, is lack of earnest and persistent application to the tasks set. But the fact that many of the poorest group do well in some tests, while many of the best group make low scores in some tests, would indicate that there are other factors involved.

CONCLUSIONS

1. The correlations between freshmen university grades vary from .34 (mathematics-history) to .59 (English-history, science-history).
2. The highest correlation between class marks and test scores is .31 (English-Completion).
3. Among the tests themselves the highest correlations are found between the Association and Recognition tests, and between the Directions, Alternatives and Completion tests.
4. There is a considerable difference in the results of the tests with the best and the poorest students, but the scores are so variable as to be of little value for individual diagnosis. This conclusion does not in any way invalidate Professor Thorndike's claims for the tests he proposed, for those tests were in part different, were to be given individually, were to have no time limit, and were to be given in four different forms to each individual.
5. There is little doubt that if a larger number of trials with similar forms of each test had been possible, the scores would have become "steadier," and the correlations between the tests higher.

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THE STANDARDIZATION OF CERTAIN MENTAL TESTS FOR TEN-YEAR-OLD CHILDREN¹

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PROBLEM

The aim of the present study is to standardize as far as possible certain mental tests for ten-year-old children. The tests used involve the following mental processes:

1. Rate of perception,—A tests
2. Immediate Memory,—Whipple's 13 picture chart
3. Association,—Two opposites tests (Woodworth and Wells)
4. Learning,—Association of numbers with certain geometrical forms
5. Linguistic invention,—Sentence, boy river ball
6. Mechanical invention,—2 rectangle triangle tests
7. Judgment
 - (a) Selective,—Reasons for grass growing in summer
 - (b) Problem questions

MATERIAL

These tests were given to 115 unselected ten-year-old children in the Iowa City Public Schools. There were 51 boys and 64 girls. The Grade distribution was as follows:

	<i>Grades</i>						
	I	II	III	IV	V	VI	Total
Boys.....		5	9	15	17	5	51
Girls.....	1	1	5	18	31	8	64
Total.....	1	6	14	33	48	13	115

DESCRIPTION AND METHOD OF GIVING THE TEST

In General. The two co-workers in these tests tested about the same number of pupils. Each pupil was given the tests individually, removed as far as possible from all disturbing elements. It was the aim to secure as nearly as possible uniform conditions. This was secured by means of separate rooms, and secluded por-

¹ A study from the Educational Psychology Seminar, 1914-1915.

tions of the hall. In all cases the subject was placed at a table directly opposite the experimenter, and was at all times made to feel at perfect ease as far as possible. The stop watch was used in taking the time. Both experimenters used the same methods of approach to the tests and adopted standard methods of giving each of the tests. These will be described in the succeeding sections.

Rate of Perception—This test was a combination of two A tests. "A test" number one, consisting of 50 capital A's distributed irregularly on a sheet of paper, was given first to each child. The subject was told to draw a line through each A as quickly as he could. Time was taken from the instant the first check was made and ended with the last. The time was recorded on the score card. For the final score in this test a penalty of two points (seconds) for each A omitted was added to the time scored.

The second part of the test was A test No. 2, in which the A's are intermingled with other letters but at practically the same intervals apart as in test No. 1. The child was told to pick out the A's as fast as he could and mark them as in the preceding test. The time was taken in the same manner as described above. A penalty of six points (seconds) was added for each omission.

In order to secure as nearly as possible the rate of perception of the child the attempt was made to eliminate the motor factor involved in a test of this kind. This was done by subtracting the score of each pupil in test No. 1 from his score in test No. 2. Test No. 1 is almost entirely a test of motor ability and represents practically the same motor adjustments as test No. 2. The above process of obtaining the child's perceptive ability was suggested and used by Squire² and seems to be a more important index of ability than the ordinary A test. The objection may be raised that this method does not eliminate the eye-motor factor. This is true, but it seems a negligible factor for the purpose of this test.

Immediate Memory—The ability in immediate memory was tested by means of Whipple's chart of thirteen pictures of familiar objects. The child was directed as follows: The card was placed face down in front of the child so that it could be easily exposed. The subject was given these instructions: "I have here a card with some pictures on it. I want you to look at it carefully for a

² SQUIRE, CARRIE R. *Graded Mental Tests*. Journal of Educational Psychology, 3: 1912, p. 370.

little while. I am then going to put it down so you can't see it and ask you to tell me what you saw." The card was then exposed for fifteen seconds, when it was placed out of sight. After an interval of one minute the child was asked to tell what was seen.

The score given in this test was simply the number of pictures remembered. If eight were recalled, eight was the score obtained, etc.

Association—Two tests of opposites of twenty words each were used to test controlled association.³ Test No. 1 was given first. The list was placed face down before the child. It was first ascertained whether the child knew what is meant by an opposite of a word. The procedure was as follows: "I have here a list of words and I want you to give the opposite of each word. Do you know what the opposite of a word is?" No matter what the answer of the child the observer continued. "If a knife is not dull what is it?" If the child answered "sharp" without hesitation the test was then given. If not, he was told the answer and given a second example. "If a person is not young, what is he?" If the child still seemed uncertain, he was worked with further until the experimenter was satisfied that he knew what was wanted. The subject was then given these instructions: "You know, now, what the opposite of a word is. I want you to give the opposites of these words as fast as you can. Give just the opposite." Time was taken from the moment the list of words was exposed until the last word had been given. On a separate list the experimenter checked all omissions, errors, and those partly right.

The final score was obtained by adding to the time six seconds for each omission or error and three for each opposite partly right.

*Learning*⁴—The card containing the five numbered geometrical figures was placed face down before the child. The following instructions were given: "I have here a card with some triangles, squares, diamonds and circles. Each one of these squares, triangles and circles is numbered. I want you to look at them a while so that you will know the number of each square, triangle,

³ For these lists see *Association Tests*, Psychological Review. Monograph Supplements, Vol. XIII, No. 5. 1911.

⁴ A sample of this test will be sent to anyone desiring to see it.

diamond and circle. Now study carefully." The card was then exposed ten seconds. A card containing fourteen blank geometrical figures was then handed to the child, who was asked to put in the right number in each square, triangle, circle, etc. If no mistakes were made on this card the test was considered finished. If any mistakes did occur, the child was told that all were not right. He was given five seconds more in which to study the numbered figures. A second blank was handed him. This sheet also contained fourteen figures, but in different order from the first blank. If mistakes still occurred he was given another study period of five seconds until four such had been given. If he did not succeed the fourth time the test was ended.

The score was derived by means of a system of arbitrary weighting. If no errors occurred after one learning the score received was 0. But if errors occurred after the first learning, one point penalty was given for each error out of the fourteen chances. For the second learning, two points penalty was given for each error; third learning, three points; and fourth learning, four points. The final score was the sum of all the penalties.

Linguistic Invention—This test was based upon the rapidity with which the child was able to give a perfect sentence containing the words "boy, river and ball." The experimenter first tested the child's knowledge of a sentence. Certain of this point, he proceeded with the test as follows: "I want you to make one sentence with those three words in it. Put all the words in the same sentence. These are the words; boy, river and ball." Time was recorded from the instant the last word, "ball," was spoken, until the child had given a sentence as requested.

The score was entirely one of time.

Mechanical Invention—In order to determine this ability two tests were given. Test No. 1 consisted in placing the two triangles together so as to form a rectangle.⁵ A rectangular piece of cardboard and at the same time the two triangles, placed in such a position that the solution of the problem was not thereby suggested, were placed upon the table before the child. Directions given to the subject were to put the triangles together as fast as he could, so that they would look like the rectangle. Time was recorded from that instant until the completion of the problem. A time limit of three minutes was given. Any one failing in this time was scored "Failed."

⁵ Binet test No. 55 of the 1908 series.

The second test was administered in exactly the same way. This consisted of three triangles formed by dividing one of the triangular cards of the previous test by cutting from the corner opposite the hypotenuse to the hypotenuse. This division was not perpendicular to the hypotenuse.

The score in both of these tests was the time taken to perform them, or "Failed" if not completed in three minutes.

Judgment—

1. Selective Judgment: This test is composed of ten reasons why grass grows in summer and not in winter. The score in this test was taken to consist of the number of reasons correctly evaluated.

Judgment Test

The following reasons have been given to show why grass grows in summer and not in winter. Write *yes* after those reasons you consider good and *no* after the reasons you think poor.

1. Summer is warm and winter is cold.
2. Grass is green.
3. Grass needs warmth.
4. Grass needs sunshine.
5. Cows and horses eat grass.
6. Grass needs moisture.
7. The ground is frozen in winter.
8. Children skate in winter.
9. Grass is sometimes cut for hay.
10. Grass could not grow in the frozen north.

The score in this test was taken to consist of the number of reasons correctly evaluated.

2. Problem Questions: This test consisted of the following five problem questions.

(1) A boy said, "I know ten good men who are doctors, and ten bad men who are policemen. So doctors are better than policemen." Did he prove it? Why? Or why not?

(2) If all the boys who are good in arithmetic are good in spelling, will all the boys who are good in spelling be good in arithmetic? Why? Why not?

(3) If there were no bread or flour would everyone starve?

(4) Is this true? "The more we eat, the more we grow."

(5) If there were no schools, would children learn anything?

These were asked orally by the experimenter and answered orally.

The answers were scored as follows: If correct and reasoned correctly a credit of *two* was given; if correct but not correctly reasoned, that is, answered intuitively, one credit was given. The final score was the total of the scores for each problem.

RESULTS

1. *The rate of perception test.* The median scores of the boys and girls are given separately by grades in Figure 1. It should be remembered that the lower the score number the better it is. It will be seen that the ten-year-old boys and girls who are in the fifth and sixth grades are closely alike, while in all the grades below, the boys are considerably inferior to the girls. In grades four, five and six the scores range from slightly less than 100 to over 250; in the grades below the fourth the range is from less than 150 to 300. The median score for all ten-year-old boys is 195 and for all ten-year-old girls 161.

One might conclude from the grade correlation shown in this figure that the test as here given is a good measure of one phase of the mental ability of children of this age. We believe that the modification of the "A test" here used (suggested by Squire) has distinct advantages over the ordinary type of "A test." The test as usually given never shows a high correlation with mental ability, but in this modification the correlation is distinct with grades and it may be assumed, fairly, we think, that the progress in the grades is at least some measure of ability.

2. *Immediate memory.* In every grade there was great variability of these ten-year-olds in the scores on immediate memory. In the sixth grade the range for boys is 6 to 9 points. For the girls of this grade the range is greater, 4 to 10. The variations in the median accomplishment of boys and girls by grades is shown in Figure 2. From this it will be seen that there is little or no correlation with grade advancement. The results here obtained suggest the need of further investigation of this and similar tests. Other tests in immediate memory in school children have led to opposite conclusions from those presented here, but in many of these tests not as many children were included as in our experiment. We suggest, supposing that our results are accurate, that it is not immediate memory but retentive memory that is correlated with school progress.

3. *Association.* The same wide range of abilities was displayed in this test as in the preceding. Both boys and girls in each grade show the same variations, from the best score, *forty*, to the poorest, *two hundred*. Figures 3 and 4 give the variations of the medians by sex and grade in these two opposites

tests. These curves show that list No. 1 is easier than list No. 2.

Sex variations. In opposites test No. 1 the medians of the boys are better than those of the girls in all grades but the three lowest. In the other list, No. 2, the superiority of the boys is quite as marked. (See Figures 3 and 4.) The medians of the boys in the two tests are 69 and 92 and those of the girls are 84 and 105. Bonser* found in the groups he tested that girls in the 5th and 6th grades excelled the boys in the opposites test. He also found much the same grade correlations as appear in our study. Practically all who have used opposites tests have found good correlations with other measures of ability.

4. *Learning.* Wide variations of ability appear in this test. Twenty per cent. of these ten-year-olds were able to accomplish the test without error in the first trial, *i. e.* after one learning, 22 per cent. required two trials or two learnings, 22 per cent. required three trials, 8 per cent. four trials and 28 per cent. failed altogether. In other words 42 per cent. were able to perform the test in one or two learnings and 58 per cent. were not.

Sex differences. The girls' median scores excel those of the boys in all grades except the 4th and 5th. But on the whole the girls have only a slight lead over the boys, their median being 16, in terms of penalties, and that of the boys being 17. The sex differences by grades are shown in Figure 5. It will be seen that the grade correlations are good except in the case of the lower grade girls and as there were only 7 in this group the median score is not of much significance. It may be, however, that this group of seven girls is a little above the average for in the "perception test" they also proved to be superior to the girls of the 4th grade.

5. *Linguistic invention.* Sex variations are not striking but the girls are slightly superior to the boys, the median time of the former being 8.3 seconds and of the latter 10.2 seconds. The correlation with grade advancement is good. (See Figure 6.) Boys and girls together made the following scores by grades: Grades 1st to 3rd, 17 seconds, 4th grade, 9.4 seconds, 5th grade 8.3 seconds, and 6th grade 5 seconds.

6. *Mechanical invention, No. 1* (to reconstruct a diagonally bisected rectangular card). Forty of our ten-year-olds were able to perform the test in five seconds or less, and fifty-two

* See his "*Reasoning Abilities of School Children.*"

were able to do it in ten seconds or less, 50 per cent. completed the test in fourteen seconds or less and 25 per cent. were not able to do it in less than 47.3 seconds. The middle 50 per cent. lies between 3.4 and 47.3 seconds. The sex and grade differences in medians are not shown here for want of space; however the boys as a whole led the girls by a median score of 9 to 17 seconds. The grade correlation was not perfect for the girls but the ability of the boys varies throughout directly with the grade.

7. *Mechanical invention, No. 2.* This test is obviously more difficult than No. 1. Of all the ten-year-olds, 9 per cent. finished the test in less than one minute, 14 per cent. took from one to two minutes, 9 per cent. from 2 to 3 minutes and 68 per cent. failed in the 3 minutes allotted to it. It would seem therefore, that the test as here given is too hard for ten-year-olds. Squire does not agree with this conclusion. She found that the 9 ten-year-old children in her unretarded group completed the test with an average score of 89.3 seconds. In our test, the 35 children who were able to complete the test at all made an average score of 90 seconds, and the remainder of the group, 75 in all, were not able to do it all in three minutes. Squire also found that her ten-year-old group completed test No. 1 in the average time of 2.1 seconds. We found that 110 ten-year-olds completed the test in a median time of 14 seconds, approximately the average time. It does not seem that Squire's results are valid for a large group of non-selected ten-year-olds.

The sex and grade differences in the medians for this test are given in Figure 7. The grade correlation is fairly good. The girls are slightly better than the boys on the whole, 34 per cent. of them finishing in 3 minutes or less and 30 per cent. of the boys succeeded in 3 minutes or less.

8. *Judgment, selective.* Reasons why grass grows in summer. The same wide variation in ability is revealed by this as by the preceding tests. The median score for these 110 children was 4.7 and the middle 50 per cent. of the group lies between the scores of 4.2 and 5.9.

Sex and grade differences. Figure 8 shows that there was little difference between the sexes. The grade correlation is not so pronounced as in the previous tests. Judging from the high median score of the 6th grade as compared with the other grades, it is possible that the test does differentiate the brighter from the normal and retarded groups. It was observed that, with very few exceptions, the child in the 5th grade and lower

answered each question simply with reference to its intrinsic validity and lost sight completely of the problem in hand. For instance the statement "Grass is green" would be checked as a correct statement, the child failing to see that the question was to select the good reasons for grass growing in summer. But with the ten-year-olds who were in the 6th grade this was not the case. They alone seemed to appreciate the problem. We suggest that this test is chiefly valuable for this age as a means of differentiating the superior from the average child. A score of 7 rights or even of 6 would be an indication of superiority.

9. *Judgment, problem questions.* The median score for our group of 115 ten-year-olds was 5.4. The middle 50 per cent. is distributed between 2.8 and 8.3.

Sex differences. With the exception of grade 6 the differences between the boys and girls are negligible. This is brought out in Figure 9. The median for the entire group of girls is 5.9 and for the boys, 5.1. This same figure also shows how far the median standings of each grade are related to grade progress.

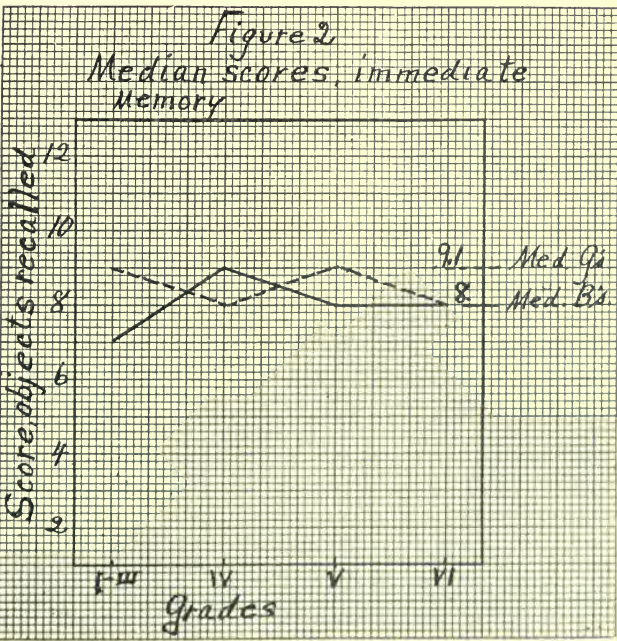
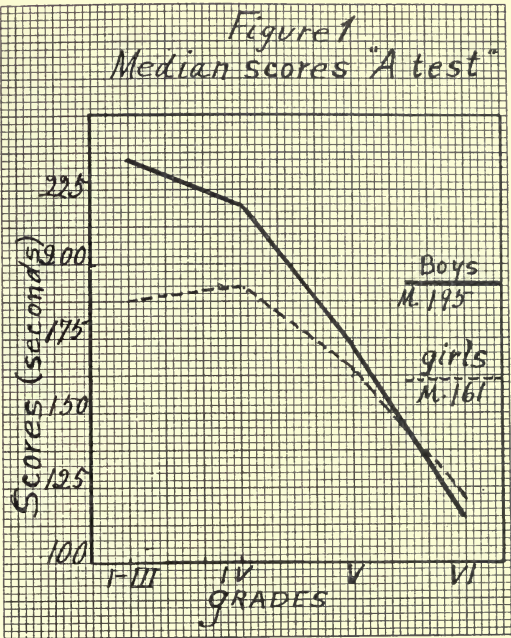
A COMPARISON OF THE AGGREGATE ACHIEVEMENT OF BOYS AND GIRLS

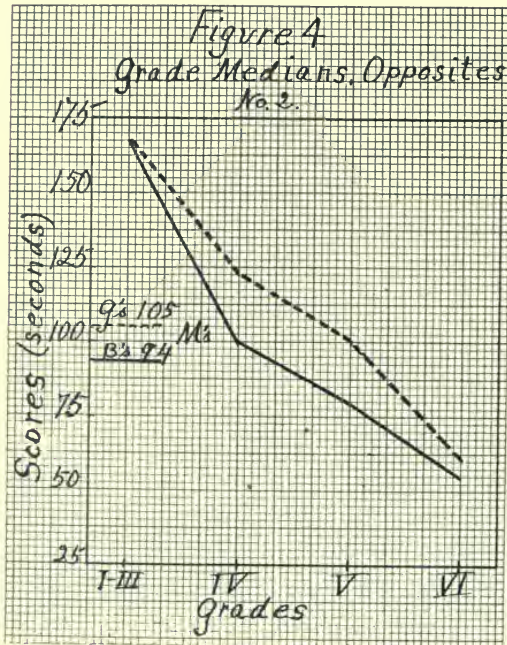
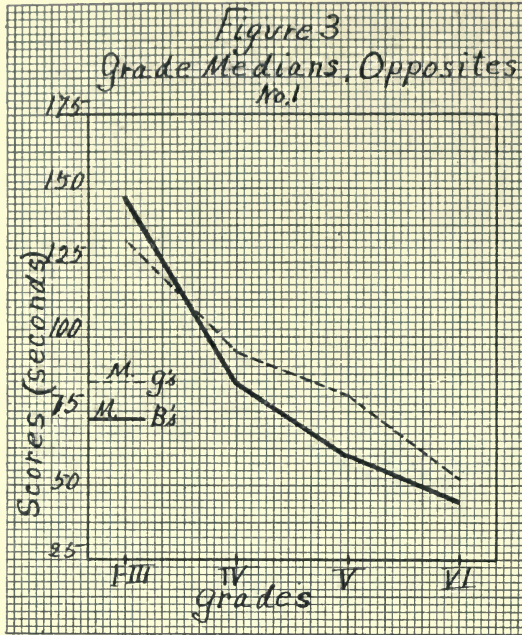
In order to make these comparisons both sexes were ranked in the same series. This was based upon the total of the rankings in all the tests. The one with the lowest total would then rank 1, with next to the lowest total, 2, etc. A quartile distribution was then made and it was found that 14 or 28 per cent. of the boys were in the upper quartile as against 13 or 22 per cent. of the girls. This is shown in Table 1. It appears, also, that 64 per cent. of the boys were in the upper 50 per cent. and only 37 per cent. of the girls. From these figures the only conclusion is this—Boys excel in the performance of these tests.

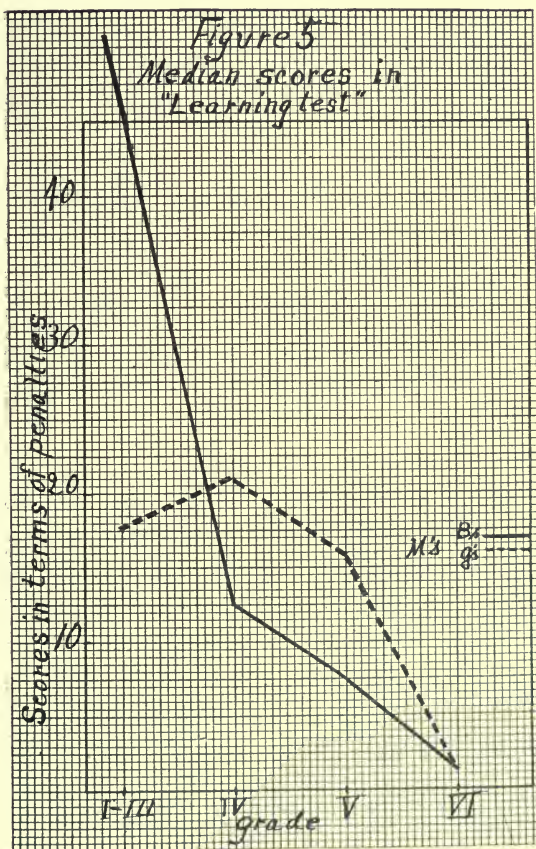
TABLE I.

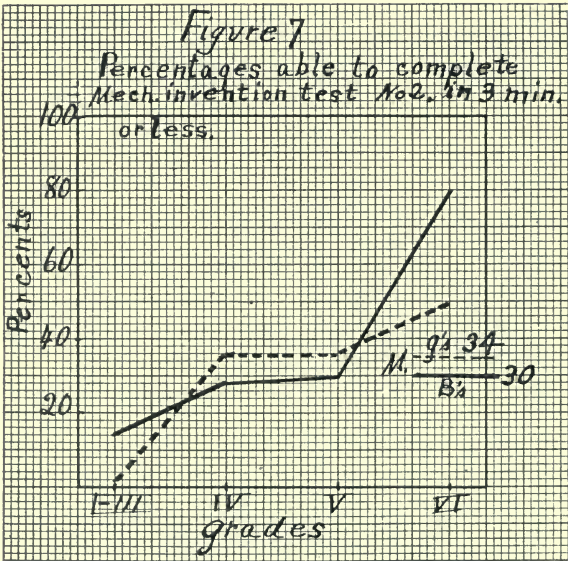
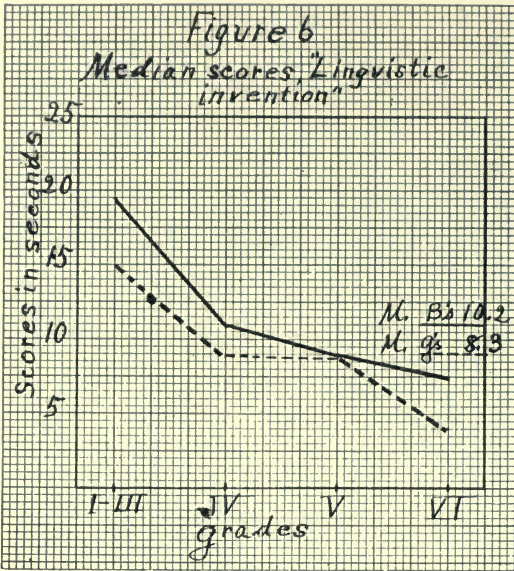
Showing the Quartile Distribution of the Rankings of Boys and Girls.

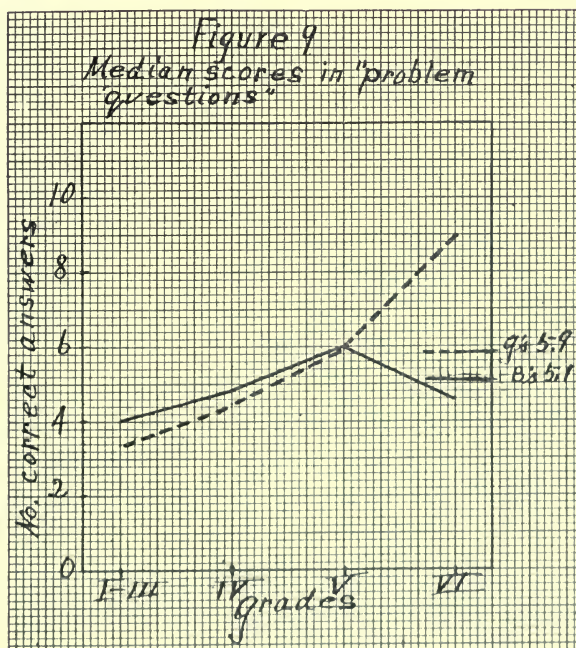
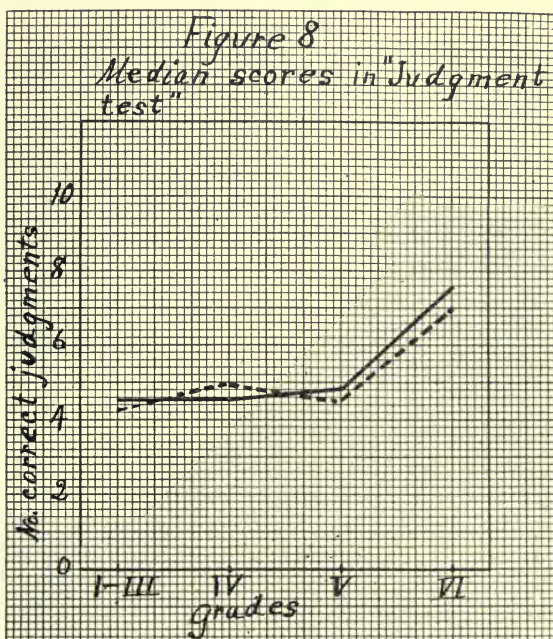
	Boys		Girls	
	No.	%	No.	%
1st 25%.....	14	28	13	22
2nd 25%.....	18	36	9	15
3rd 25%.....	10	20	17	29
4th 25%.....	8	16	20	34
Upper 50%.....	32	64	22	37
Lower 50%.....	18	36	37	63











A STUDY OF PHYSICAL GROWTH AND SCHOOL STANDING OF BOYS¹

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This paper represents an attempt to study the relation of physical growth and school standing of boys. It deals with the physical measurements and school standing of 207 boys of the elementary and the high schools of the University of Chicago.

The physical measurements extend over the eight years from 1906-7 to 1913-14. For a few boys the records are complete for as many as seven successive years, but in most cases interruptions occur. The heights are expressed in centimeters and the weights in pounds. These measurements were made by the physical director of the school of education according to generally accepted methods. Each scholarship mark is the average of the office marks for the regular academic subjects. Marks for writing, drawing, music, manual work, and physical exercises are not considered.

The first part of the study deals with average heights and average weights of groups of boys of different school grades. The second part is a study of the individual records of twenty-nine boys whose physical measurements are complete for four or more successive years. The third part is a summary of the points suggested.

PART 1. AVERAGE HEIGHTS AND WEIGHTS

The groups considered in the first part include all the boys who have physical measurement records for the eighth grade or for the freshman year in high school. A few of the boys have records for one year only, but in a majority of cases the measurements cover a period of several different years. Chart I indicates that 175 of these boys have records for the freshman year of high school. The groups are smaller for the preceding and the following years. Care is taken to include all of the boys who have records for the freshman year because that is the period of greatest average increase in weight and in height as indicated in Charts III and IV.

¹ This study was made in connection with a course in Experimental Education under Dr. Frank N. Freeman of the University of Chicago. To him the writer is under obligations for suggestions and criticisms.

CHART I
Averages of Weights by Ages and Grades

Ages	Number of Boys	4	5	6	7	8	I	II	III	IV
9	12	3 58.1	7 66.14	2 61.3						
10	26		9 65.3	13 73.27	3 68.3	1 70				
11	38		3 78.2	15 71.4	17 88.4	3 75.9				
12	63		4 79.8	5 91.7	21 79.18	27 95.16	6 90.6			
13	113		1 72	4 89.8	7 91.47	41 90.3	54 96.9	4 88.6	2 95.5	
14	120				6 100.9	15 106.14	73 102.8	25 105.8	1 107.5	
15	97				1 85.2	5 116.5	31 114.8	44 117.9	13 123	3 122.9
16	65					1 94.8	10 126.3	20 132.8	25 125.7	9 135.8
17	36						1 107	8 124.7	2 124.5	25 137.19
18	13									13 142.8
	583	3	24	39	55	93	175	101	43	50

Chart I gives the averages of 583 weights distributed by ages and by school grades. The heavy rectangles indicate the normal positions of those boys who entered school at six years of age and who have advanced one grade each year. The small figure above each average indicates the number of boys whose measurements are represented by that average.

For any given age, the boys one year above the normal grade average heavier than the boys of the normal grade. Also, except for fifteen and for seventeen years, the boys one year below the normal grade average heavier than the boys of the normal grade. Possibly the exceptions at fifteen and seventeen years may be partly due to the changes in relative weight which occur at this time. Some of the boys who were light now surpass some of the boys who were heavier.

Until the eighth grade is reached, the groups of pupils below normal grade are relatively small. During high school, the groups of pupils above normal grade are relatively small. This change in the distribution is due to the fact that more boys are

considered for the freshman grade than for the preceding and the following grades. Probably averages of small groups are not very significant. So emphasis will be placed upon those averages which represent larger numbers of measurements. When this is done, there appears to be a positive relation between weight and scholarship in the elementary grades, but the relation in high school is uncertain.

CHART II

Averages of Heights by Ages and Grades

Ages	Number of Boys	4	5	6	7	8	I	II	III	IV
9	11	3 127.9	6 134.4	2 139.6						
10	26		9 136.2	13 140	3 143.7	1 134.9				
11	38		3 139.9	15 139.27	17 146.8	3 145.7				
12	63		4 146.8	5 146.12	21 145.5	27 152.0	6 152.6			
13	112		1 138	4 152.8	7 152	41 151.3	53 154.8	4 153.8	2 151.5	
14	120				6 156.8	15 159.8	73 159.1	25 160.6	1 162.0	
15	97				1 146.2	5 166.4	31 164.8	44 166.2	13 170.2	3 172.9
16	65					1 156.1	10 168.6	20 170.9	25 170.2	9 174.0
17	36						1 162	8 168.4	2 167.5	25 173.5
18	13									13 172.8
	581	3	23	39	55	93	174	101	43	50

Chart II shows in a similar manner the distribution of the averages of 581 heights. The interpretation is similar to the interpretation of Chart I. For any given age, boys one year above the normal grade average taller than boys of the normal grade. Also, except for 15 and for 17 years, the boys one year below the normal grade average taller than boys of the normal grade.

If medians instead of averages are used in Charts I and II, the distribution will remain unchanged.

Smedley and Porter found that boys at or above grade were heavier and taller than boys below grade. In their investigations each boy was measured only once. Baldwin considers the same

boys through a period of several successive years. His results indicate that height and weight are favorable conditions to scholarship. However, the above investigations do not indicate that boys below normal grade are likely to be taller and heavier than boys of the normal grade.

CHART III

Averages of Increments of Weight by Ages and Grades

Age	Number of Boys	5	6	7	8	I	II	III
10	21	9 5.5	10 9.3	2 6.9				
11	36	2 7.3	14 7.7	18 9.9	2 9.7			
12	47		3 8.2	23 9.9	21 11.0			
13	62			7 14.4	34 10.1	21 14.8		
14	54				8 14.7	41 14.6	5 22.1	
15	29					15 12.2	14 10.7	
16	17					5 8.6	3 9.6	9 10.2
	266	11	27	50	65	82	22	9

CHART IV

Averages of Increments of Height by Ages and Grades

Age	Number of Boys	5	6	7	8	I	II	III
10	20	8 3.3	10 5.6	2 4.3				
11	36	2 4.9	14 5.5	18 5.6	2 5.2			
12	46		3 8.2	23 5.57	20 5.43			
13	61			7 8.14	34 6.51	20 7.8		
14	54				8 6.9	41 7.4	5 9.8	
15	29					15 6.25	14 3.68	
16	18					5 2.6	3 2.8	10 3.55
	264	10	27	50	64	81	22	10

Charts III and IV show the distribution of the averages of 266 increments of weight and 264 increments of height. With one exception, groups one year ahead of the normal grade are increasing more rapidly both in weight and in height than are normal groups of the same age. For some ages, the groups one year below normal are increasing more rapidly than are the groups of normal grade.

So when averages of groups are considered, the preceding charts suggest that until near the middle of high school most boys superior in weight and in height are likely to excel in school standing. But we find numerous exceptions to the above suggestion. Group averages are not trustworthy in that they do not provide for individual variations. For example, of the freshman boys who were thirteen years of age, the heaviest boy weighed 199 pounds while the lightest weighed 73.9 pounds. The group average was 96.9 pounds. Of the eighth grade boys who were thirteen years of age, the heaviest weighed 126 pounds while the lightest weighed 68.3 pounds. The group average was 90.3 pounds. Similar cases of overlapping occur throughout the four charts:

CHART V
Averages of Weights by Ages and Grades

Age	Number of Boys	5	6	7	8	I	II	III	IV
9	6	5 69.8	1 61.6						
10	15	5 68	9 75.4	1 68.3					
11	19	2 85.5	7 72.5	9 84.6	1 73.2				
12	21		3 87.7	7 80.1	10 91.6	1 89.2			
13	24			4 91.7	8 87.9	12 103.2			
14	25				4 105.8	13 107.2	8 112.		
15	13					3 111.2	8 121.2	2 137	
16	13						3 123.6	8 130.3	2 149
17	9							1 125	8 140.1
18	1								1 132
	146	12	20	21	23	29	19	11	11

CHART VI
Averages of Heights by Ages and Grades

Age	Number of Boys	5	6	7	8	I	II	III	IV
9	6	5 137.9	1 138.3						
10	15	5 137.7	9 140.8	1 141.2					
11	19	2 142	7 139.8	9 146.1	1 145.1				
12	21		3 144.2	7 144.9	10 152	1 151.9			
13	24			4 141.0	8 145.8	12 144.1			
14	25				4 157.9	13 159.6	8 164.2		
15	13					3 161.9	8 168.9	2 174.7	
16	13						3 174.0	8 171.5	2 182.6
17	9							1 175	8 174.6
18	1								1 177.3
	146	12	20	21	23	29	19	11	11

given above. Hence to apply group averages to individual pupils would be misleading.

That group averages are not sufficient will be shown by a comparison of the results secured when the 29 boys who have records for several successive years are considered in groups and when they are considered as individuals.

Chart V distributes the averages of 146 weights of the 29 boys. Chart VI distributes the averages of 146 heights of the same group. Twelve of these 29 boys have records extending back to the fifth school grade. Three of the boys have records for seven years and three have records for eight years in succession. These 29 boys were members of three different classes. Eleven were members of the class of 1914, fourteen were members of the class of 1916, and four were members of the class of 1917. These charts are to be interpreted in a manner similar to Charts I and II. Chart V indicates that all of the groups above normal, also all of the groups below normal and under fourteen years of age, average heavier than the normal groups. Chart VI indicates

that all but the thirteen year old group above normal, and the eleven, sixteen, and seventeen year old groups below normal, average taller than the normal groups.

CHART VII
Group of Eight Boys Divided on Basis of Scholarship

	Freshman	Sophomore	Junior	Senior
Upper Group Boys	B, C, D, I	B, C, D, I	B, E, G, I	A, B, E, I
Average Wt.	109.4	122.5	125.8	146.4
Average Ht.	161.6	171	172.6	176.0
Lower Group Boys	A, E, F, G	A, E, F, G	A, C, D, F	C, D, F, G
Average Wt.	106.4	119.8	135	133.9
Average Ht.	160.2	166.9	170.4	175.7

Chart VII concerns eight boys of the same age who entered high school in September, 1910, and who graduated in June, 1914. Since in each class there is considerable variation in age, this is the largest group of the same age and of the same class which has complete physical measurements during the high school course. Each capital letter indicates the same boy throughout the study.

For each year above the elementary school, these eight boys are separated into an upper four and a lower four on the basis of their scholarship marks. Then the averages of height and of weight of the two groups are compared. Throughout the four years the half which ranked higher in scholarship also averaged taller. And, except in the Junior year, they also averaged heavier. The exception in the Junior year is due partly to the fact that E and G now enter the upper scholarship group and displace C and D who are slightly heavier. These four boys are so nearly equal in scholarship that a very slight change may rearrange the ranking.

Thus it is seen that a study of group averages of the twenty-nine boys, as indicated in Charts V and VI, shows practically the same thing as does a study of the group averages of the entire 207 boys as indicated in Charts I and II. That is, groups one year above the normal grade average both heavier and taller than groups of the normal grade. Also, in some cases, groups one year below the normal grade average both heavier and taller than groups of the normal grade. Chart VII indicates that in a group of boys of the same age and the same class, those of high scholarship average both heavier and taller than those of low scholarship.

PART II

Next, the twenty-nine boys are considered as individuals. In Chart VIII (which is too voluminous to print in this article) a comparison of scholarship marks with increments of weight and height is made for the different years. Curves are plotted to represent the scholarship marks and the increments of growth for each of the twenty-nine boys. Since these boys were members of three different grades or classes, the average of the teachers' marks for each group is considered separately. For example, Boy A was one of the eleven boys of the class of 1914. So his scholarship mark for any year is considered with reference to the average of the teachers' marks for the eleven boys of that year. All of the eleven boys did not have exactly the same subjects, and of those who did have the same subjects probably all did not have them under the same teachers. But it is probable that the teacher's marks for any group of boys are a fairly reliable indication of the relative ability of the members of that group.

Since standards of grading may vary from year to year, a common basis of comparison is desirable. So the average of the teachers' marks for each year is weighted by being raised to 100% and is then represented by the base line. Then the average scholarship mark of each boy for the year is weighted in the same degree. For example, an individual average that was nine-tenths of the class average now appears as 90%, and is located ten points below the base line. An individual average that was eleven-tenths of the class average is now 110%, and is located ten points above the base line. For each group, the average increments of weight and of height are found. These averages are represented by the base line. Then the difference between the average and any individual increment is indicated by the distance of the curve from the base line. For example, if the average increment of height is seven centimeters, this average is represented by the base line. Then an individual increment of twelve centimeters is five centimeters above the average, and is located five points above the base line. In a similar manner, an increment of two centimeters would be located five points below the base line.

In case a change in an increment is accompanied by a corresponding change in the scholarship grade, it is considered a case of positive correlation. In case a change in increment is accompanied by an opposite change in the scholarship grade, the cor-

relation is regarded as negative. If one of the curves changes while the other remains unchanged, the correlation is considered as zero. If different kinds of correlation exist between a pair of curves, and no one kind is prominent, it is regarded as a mixed relation.

Chart VIII, too elaborate to be printed here, indicates the different relations which exist between scholarship and increment of growth. For example, Boy F has a positive correlation between scholarship and weight increment for three years and between scholarship and height increment for one year only. Boy J has a negative correlation between scholarship and height increment for three years, but scholarship and weight increment are negatively correlated during one year only. For Boy U the scholarship and the height increment have a mixed relation.

For the twenty-nine sets of curves, growth increment and scholarship are related as follows:

	Entirely +	Entirely —	Chiefly +	Chiefly —	Mixed or Zero
Wt. Increment and Scholarship	8	6	4	6	5
Ht. Increment and Scholarship	3	3	6	5	11

Thus for the twenty-nine boys, increase in weight and increase in scholarship are positively correlated throughout for eight boys and are negatively correlated throughout for six boys. For five boys the relations of scholarship and weight increment cannot be classified under any one of the four headings. So they are considered as "Mixed." The relations of height increment and scholarship are to be interpreted in a similar manner. The above tabulation suggests that when sets of curves are considered there does not seem to be any decided relation between scholarship and physical growth.

Chart IX distributes by school grades the yearly correlations of all of the twenty-nine boys. The numbers indicate that there is slightly more positive correlation of scholarship and weight increment during high school than during the preceding grades. For scholarship and height increment there is slightly more negative than positive correlation.

Chart X shows the same yearly correlations distributed by ages of the boys. For boys of thirteen years or over, there is slightly more positive correlation of scholarship and weight increment

CHART IX

Correlation of Curves for Each School Grade

School Grades	Weight and Scholarship			Height and Scholarship		
	+	—	0	+	—	0
5-6	2	1		2		1
6-7	8	7	3	6	6	6
7-8	7	6	5	5	8	4
8-I	6	10	1	7	8	1
I-II	6	4	1	3	6	2
II-III	7	3	1	4	4	3
Totals	36	31	11	27	32	17

CHART X

Correlation of Curves for Each Year of Age

Ages	Weight and Scholarship			Height and Scholarship		
	+	—	0	+	—	0
10		1				1
11	5	5		3	4	3
12	4	5	5	2	4	7
13	4	7	3	6	7	2
14	6	3	3	8	3	1
15	6	6	2	3	7	4
16	5	3	2	5	3	2
17		1				1
Totals	32	31	15	27	28	21

than there is for younger boys. There seems to be little relation between scholarship and height increment.

The preceding charts (IX and X) which deal with correlations do not indicate that there is much relation of scholarship and physical growth. But these correlations do not regard the stage of development of the boy. They assume that growth at one period means the same as growth at any other period; also, the size of the boy, or the sum total of previous growth, is not taken into consideration.

The size of the boy and the rate and the time of growth are indicated on Chart XI (too extensive to be printed here). The curves of absolute height and absolute weight of all of the twenty-nine boys are plotted. By these curves, one is able to tell the increment of growth, and the absolute height and weight of each boy. For many of the boys we are able to judge something of the

stage of development. That is, has the boy nearly reached his adult height, is he now in a rapidly growing period, or will the later growth probably be more rapid? In all but six cases, each boy's stage of rapid growth can be approximately located for either weight or height, or both.

When the curves of a group of boys are plotted on one sheet, it is easy to rank the boys according to weight and height during any school grade or at any particular age. Since all of the twenty-nine boys considered have records for the freshman year, the ranking is made for that year. The twenty-nine boys were members of three different classes. Of one class, all but two boys were fourteen years of age during the freshman year. For the thirteen year old boy, the sophomore measurements were used, and for the fifteen year old boy the eighth grade measurements were used. Of the other two groups, a majority were either thirteen or fourteen years of age while in their freshman year. So the weights and heights of each boy at fourteen years of age were used.

CHART XII

Relation of Weight and Scholarship

14-year Weight	Period of Rapid Growth	Kind of Work Done by Each Boy
Heavy	Early	B—high and steady; O—below to above average; S—high; BB—from below to above average; Q—above average and increasing.
Heavy	Medium	C—from high to low; J—average and unsteady; AA—average to high; U—average to low.
Heavy	Late	A—below average and decreasing; X—low.
Average	Early	L—high and increasing; W—below-average-below.
Average	Medium	D—below average and steady; K—high and increasing; H—above average and unsteady.
Average	Late	None.
Average	Indefinite	P—low and unsteady; T—low and decreasing; Z—high and increasing.
Light	Early	F—low and decreasing.
Light	Medium	E—low and unsteady; G—from below average to average.
Light	Late	I—average to high; Y—low but increasing; CC—average to very low; (Y and CC are older than the other boys).
Light	Indefinite	M—high and decreasing; N—high and unsteady; R—above average and steady; V—below average and unsteady.

Chart XII indicates the weight at fourteen years, the period of most rapid increase in weight, and the scholarship standing of each of the twenty-nine boys. The chart may be summarized as follows:

Heavy boys who develop early, average boys who develop at medium periods, and light boys who develop late, rank well in scholarship in eight cases and poor in three cases. Two of these are boys of over age. Light boys whose rapid development periods can not be definitely located rank well in three cases and low in one case. These indefinite cases seem to have no rapid growth previous to fourteen or fifteen years. It is probable that the rapid period occurs late if at all. Heavy boys who develop late and light boys who develop at early or medium periods rank well in no case and poor in four cases. For the remaining cases, it is difficult to make any general statement. Four are doing poor work, three are doing good work, and the work of the other two is about average.

CHART XIII

Relation of Height and Scholarship

14-year Height	Period of Rapid Growth	Kind of Work Done by Each Boy
Tall	Early	B—high and steady; S—high.
Tall	Medium	A—below average and decreasing; C—from high to low; L—high and increasing; Q—above average and increasing.
Tall	Late	J—average and unsteady.
Tall	Indefinite	O—below to above average; AA—average to high.
Average	Early	U—average to low.
Average	Medium	K—high and increasing; X—low; BB—from below to above average.
Average	Late	G—from below average to average; H—above average and unsteady.
Average	Indefinite	N—high and unsteady; P—low and unsteady T—low and decreasing.
Short	Early	None.
Short	Medium	F—low and decreasing; I—average to high; V—below average and unsteady; Y—low but increasing.
Short	Late	D—below average and steady; E—low and unsteady; CC—average to very low.
Short	Indefinite	M—high but decreasing; R—above average and steady; W—below-average-below.
Indef.	Indefinite	Z—high and increasing.

Chart XIII suggests the following relations between scholarship and height:

Tall boys who increase rapidly at early or medium periods and average boys who increase rapidly at medium periods are doing good work in six cases and poor work in three cases. Tall boys and short boys whose periods of rapid increase are indefinite are doing well in four cases and average in one case. It is possible that some of these indefinite cases increase rapidly too late to be indicated on the curves. Short boys of medium period and short boys of late period do well in one case and poorly in six cases. Of the remaining eight cases, three are doing good work, three are doing poor work, and two are doing average work.

CONCLUSIONS

From the preceding study of physical growth and school standing, a few points are suggested. Whether such points will hold when large numbers of boys are considered is a topic for further investigation. But for the boys included in this study the following statements seem to be justified:

1. When we consider averages of groups of the same age, the group one year ahead of the normal grade averages both heavier and taller than the group of the normal grade. In some cases the group one year below the normal averages both heavier and taller than the group of the normal grade.

2. When individual curves and correlations are considered without reference to the size of the boy or to his stage of development, it is difficult to see any relation between physical growth and school standing.

3. When individual curves and correlations are considered, together with the size of the body at fourteen years of age and his stage of development, the following are suggested:

- a. Heavy or tall boys of early development rank better than heavy or tall boys of late development.

- b. Light boys of late development rank better than light boys of early or medium development. Short boys of late development do not rank high.

- c. Boys of medium size or of medium period of development are hard to classify, though a majority of them appear to be doing school work of medium rank.

COMMUNICATIONS AND DISCUSSIONS

FURTHER SUGGESTIONS REGARDING MENTALITY TESTS:

I have tested several thousand children during the past two years, employing the Binet test and many other mental and educational tests, and I wish to record some of the convictions that have grown out of my experience. In the first place, I agree quite heartily with Professor Yerkes that the age arrangement or method of scoring is not so desirable for scientific use as a method of scoring which gives cumulative credit for each additional element of the test accomplished. Giving an additional credit for each successive task performed will tend, however, to distort the facts as to the relative achievements of two individuals unless these tasks are so selected as to fall at practically equal intervals along a scientific scale for difficulty of performance. If each X in the line shown below represents a task to be performed, and its position in the line represents its location upon an accurate scale for difficulty, the facts regarding relative performances will not be greatly distorted by giving one credit for each task performed.

X	X	X	X	X	X
Easy					Hard

If the same method of scoring were used in the case of the tasks represented below, however, great misunderstanding would result.

X	X	XXX	X
Easy			Hard

To say that Individual A had performed three tasks, while Individual B had performed five, would give an incorrect idea of the relative achievements of A and B in this latter instance, although such a statement would be fairly accurate if the tasks were separated as to difficulty by equal intervals, as shown in the first illustration. We must therefore take care, in arranging tasks in series, to know that the differences in difficulty between consecutive tests are relatively equal.

The problem now resolves itself into one of measuring accurately the differences in difficulty between various elements of a test series. I know of no other satisfactory way to determine the relative difficulty

point

of two such elements of a test than to try both upon a large number of appropriate individuals. The amount of difference needs, however, to be expressed in such terms as will apply equally well to the difference in difficulty between any other two elements of the test, and in such terms that any other investigator may verify the amount by trying the two elements upon a group of individuals chosen in the same manner as the group originally tested.

In certain educational tests we have assumed that ability to accomplish tasks was distributed within a given school grade according to the "normal surface of frequency," and that one such grade was just as variable as any other, because selected in the same manner by equally competent teachers. Some measure of the variability of a school grade group has been used, therefore, as a measure of differences in the difficulty of elements in the test series. It seems probable that some such function of the normal surface of frequency will be used as the common measure of difficulty for tests applicable to school children and young people. For infants, however, we shall need to find some other measure of differences.

The strongest conviction that has come to me in my work with tests is that we must have tests to measure particular abilities, rather than tests of general mental ability. Instead of reporting a child as mentally defective, we must point out the respects in which he is deficient, and to what degree. A physician does not diagnose a case as merely "a serious illness," but he seeks to discover the respects in which the patient is ill, and to base his treatment upon these particular symptoms rather than upon "poor health in general." Psychologists and educators must likewise be able to point out in what respects a boy will probably be defective for life, and must then seek to adjust training to the individual's possibilities.

As an illustration of the above statements, I found fifty boys in certain institutions of New York State who by the Binet tests were clearly three years or more below normal children of their age. A language completion test applied to these same fifty boys showed that forty-eight of them were three years or more below the normal child of the same age in their ability to complete incomplete sentences. It would have been unfair, however, to have condemned these boys as totally unpromising, for a test of mechanical construction ability applied to them showed that thirteen of the fifty were able to accomplish as much or more than the average child of the same age in the New York City public schools. It is true, of course, that good qualities go

together, and that ability to do mechanical construction work is probably closely related to ability to succeed in the Binet tests; but what we need, it seems to me, is a large variety of tests along many different lines, each test being carefully graded to show how difficult a task of that particular kind the child can accomplish.

M. R. TRABUE.

Teachers College, Columbia University.

Within the past few years one phase of my official duties has involved the applying of mental tests to several hundred subjects ranging from kindergarten children to college students. About 150 of these subjects were tested individually by me, over 100 cases involving my applying the Binet-Simon scale. Within this time also, the training and constant supervision of some 120 Binet examiners has devolved upon me. The following opinions are the result of this experience.

The criticism of the Binet-Simon test methods appears to have been due in part to the following causes: (1) The failure to distinguish clearly between the ability to administer the tests scientifically and the ability to interpret the results of such tests in the light of established or partly established norms, clinical data, etc. Graduate students have been turned loose with a syllabus-manual as practically certified Binet testers. They have registered so-called mental ages which educators, jurists, and others have been left to accept as true mental ages without regard to racial or social norms.

(2) The over-idealism of those who have been hoping (a) to establish a universal scale of mentality tests such as Yerkes heralded last year but has since abandoned, or (b) a national American scale such as Terman has been arranging.

(3) Also another form of over-idealism which prohibits interest in a provisional uniform method because statistical data are lacking as to the correctness of each detail of procedure.

(4) The absence of a laboratory manual of the Binet-Simon tests which attempts to answer provisionally the hundred and one questions of procedure in matters of test order, second chances, uniform scoring, etc., involved in every Binet examination. Yerkes' manual is an advance in this direction for those who are willing to abandon the mental level principle.

(5) The resulting lack of uniformity among mentality examiners. This was shown to be of a serious nature by an experiment conducted in New York some years ago and reported to me by Miss Farrell, Inspector of Ungraded Classes.

The value for preliminary classification of the mental level principle has been accepted either in published statements or in actual practice by (1) such experimentalists as Stern, Terman, Warren, Whipple, Witmer and others. (2) Such authorities on abnormal psychology as Goddard, Rosanoff, White and others. (3) Such educational executives as Superintendent Cornman of Philadelphia, Superintendent Hoke of Richmond, and others. (4) Such leaders in child welfare as Judge Brown of Cleveland and a large number of others who are in sympathy with the movement to use applied psychology in helping to solve social problems.

In the light of the above considerations I would suggest (1) That we endeavor to define more accurately the qualifications in the matter of training and experience for (a) Examiner psychologists who should know both how to administer accurately the several mentality scales that are now in use and how to interpret the total age scores and the individual pluses, minuses or points in the light of the racial and social averages obtained to date, together with all the other educational and social data which should accompany each test result; and (b) Field Examiners or Binet assistants, advanced students in psychology and education who should probably have as a minimum 60 hours of laboratory work together with courses in child psychology and in the technique of applying one of the accepted scales with the aid of a laboratory manual that does not necessitate psychological improvisation.

(2) That we endeavor to educate our present and future mentality examiners to the point of realizing that a Binet age, a Goddard age or a Terman age must be translated into a true mental age except for children of the same race and opportunity as those upon whom the standardization has been based. I trust that Professor Terman will emphasize this point and the need of special experience in interpreting results in connection with his revision.

(3) That we conserve what is best in the Binet principles and methods of gauging pre-adolescent mentality. For example (a) Binet after long experience found that in gauging pre-adolescent mentality, the ability to comprehend and act upon uniform directions without further explanation or demonstration formed a most important element in the complex mental processes being tested throughout the

scale. Yerkes appears to have abandoned this idea in his point-scale method by warning us not to proceed with a test until we are sure that the subject understands the instructions.

(b) Similarly, Binet found that one of the most valuable factors in his scale consisted in presenting the identical pictorial and verbal situations to all subjects so that he might compare their types of response. Terman is using a different set of pictures from those used either by Binet or by Goddard and others. Moreover, in the last form of his arrangement that I have seen Terman appears to prescribe a different form of question according as you guess the subject to be mentally three, seven or fifteen.

(4) That we coöperate in perfecting the Binet principles and methods by continuing the valuable work begun by the Informal Conference on Binet Testing at Buffalo. With this view in mind I am about to present to Professor Warren, under whom I began this psychodetic work as his Research Assistant, a provisional uniform method of applying the Binet-Simon tests as regards test order, details of administering and scoring each test, etc. This method endeavors to follow as closely as possible both the spirit and the letter of the Buffalo Conference. The method is being used under my supervision in the Philadelphia Public Schools. A Laboratory Manual embodying this method is about to be printed by the Trade School for use under my personal direction.

There are a number of other considerations which I have been hoping to embody in an article on the subject when time permitted, as for example the effect of wide range testing coupled with scientific interpretation in minimizing the importance of an ideal placing of the tests on the basis of universal or of national data, the need of a rational conservatism in applied psychology because of the practical and social issues involved, and similar topics.

NORBERT J. MELVILLE.

School of Pedagogy of the City of Philadelphia.

It has seemed to me that what we need as a basis for constructing scales of measurement is a kind of survey of the various capacities of mind and body which are now open to experimentation by fairly well recognized methods, with a view to determining what the limits of variation of each capacity are at each age. We have in this laboratory undertaken the task of making such a survey for the ages from fourteen to eighteen years. When the series is complete we shall have

measures for from 1000 to 1500 individuals of each of those ages in a variety of tests covering motor ability (strength, speed, steadiness, coördination of movement) and mental ability (perceptual processes, memory of several types, learning ability, association, linguistic ability, and ingenuity). The subjects have been chosen in such a way as to represent all native born, white individuals of a given age in the community, except those recognized as feeble-minded. The results for each test are being arranged in a ten-percentile scale. Each person in the series is then having his records in each test marked from one to ten according to the percentile within which his results fall. These percentile ranks are then being averaged first for tests of motor capacity, and second for tests of mental capacity. These average ranks are then to be arranged in a final scale.

In the laboratory in New York, established by Mrs. Lucy Sprague Mitchell, and directed during its first year by Prof. Joseph Hayes of the University of Chicago, similar norms for many of the same tests and some additional ones are being established for the ages from eight to thirteen years. When this plan is successfully carried out for the ages from six to eighteen, we can tell how much overlapping there is from year to year in each type of performance, and have a more adequate basis for deciding just what would be the best method of establishing a satisfactory scale. We could obtain rankings of this sort, for instance—This boy of fourteen ranks in his mental tests as well as twenty-five per cent. of boys of his age. Twenty-five per cent. rank for age fourteen corresponds to median for age eleven. We could do the same with tests of motor capacity. An analysis of each average percentile rank could state whether any separate tests showed marked deviation from its median.

By studying the degree of correlation between tests of different types, we ought to be able to come to some conclusion as to the extent to which abilities are general, and the extent to which they are specific. The number and variety of tests whose records should be included in forming a general scale, the choice of a sets of tests to be used for specific purposes and the weighting of given tests for special purposes are problems that seem open to solution on such a basis.

This plan presupposes the choice of a method of giving and of evaluating each test which is sufficiently satisfactory, and sufficiently well recognized to be used by everyone for purposes of general measurement. In undertaking the work I had thought that this was a safe assumption for certain tests, though I realize that there may be

a serious difference of opinion on this point. At any rate, I would like to take this opportunity to emphasize the fact that numerical mental or physical norms to be of any service must be accompanied by very complete and explicit descriptions of methods of giving and evaluating the tests on which they are based.

This office expects to furnish a scale of the type described for each age from fourteen to eighteen, to furnish a comparison of ranking in this scale with ranking on the Yerkes-Bridges Point scale, and to formulate the relation between rank in mental and motor tests, and subsequent industrial career.

HELEN T. WOOLLEY.

Bureau of Vocational Guidance, Cincinnati Public Schools.

ABSTRACTS AND REVIEWS

WILLIAM HEALY, A.B., M.D. *The Individual Delinquent: A Text-book of Diagnosis and Prognosis for All Concerned in Understanding Offenders.* Boston: Little, Brown and Co., 1915. Pp. xvi + 830. \$5.00.

Not only in respect to the timeliness of its subject-matter, but also in respect to the scope and thoroughness of its treatment, its many evidences of painstaking research and its indubitable scholarship, is this book a contribution of the first order.

As our readers will recall, the Juvenile Psychopathic Institute, projected by Miss Lathrop (now chief of the Children's Bureau at Washington) and endowed for five years by Mrs. Dummer, was established at Chicago in 1909. Dr. Healy served as Director of this Institute and the present volume presents to the public the scientific results of this half-decade of activity.

It would be absurd to attempt within the bounds of a book-review anything like a comprehensive analysis or summary of this work, but its general plan may be indicated. Book I (pp. 1-182), entitled "General Data," comprises an introduction and nine chapters dealing with Orientations, the Individual, the Mental Bases of Delinquency, Working Methods (three chapters), Statistics, and General Conclusions (as to methodology and as to treatment). Book II (pp. 183-788), entitled "Cases, Types, Causative Factors," comprises an introduction and 27 chapters dealing with heredity, developmental conditions, physical abnormalities, stimulants and narcotics, environmental factors, professional criminalism, mental abnormality (epilepsy, sexualism, criminalistic imagery, conflicts and repressions, feeble-mindedness, adolescent psychoses, insanity, pathological lying, stealing and accusation, love of excitement, etc.). The material in Book II is enriched and aptly illustrated by a wealth of detailed cases drawn from the records of 1000 repeated offenders selected from the larger number of cases that have been studied by the Institute.

It is evident that the task set by this investigation, that of unearthing the causes of criminalism, is primarily a problem of characterology. It implies an analysis of the motives of human conduct, and this becomes in considerable measure a problem of individual and differentiated psychology.

The following may be cited as random samples of some of the conclusions reached by Dr. Healy: (1) Intimate study of the individual offender is of fundamental importance. No amount of shrewdness and of familiarity with courtroom cases can replace this direct search for causative factors in each individual. (2) "There is no such thing as an anthropological criminal type." (3) A cut-and-dried classification of offenders "appears at once out of the question," though certain causal types may be differentiated, and, in general, a consideration of the mental life is the most direct way of arriving at the causal factors. (4) In each case the several causative factors, *e. g.*, defective heredity, alcoholism, poor parental control, bad companions, interact in the most intricate manner. (5) Punishment is necessary, but should not harm the offender. (6) It is of the first importance to begin treatment of the offender as early as possible in his career. (7) For effective work, courts need to be reorganized by extending the juvenile court method up to the age of 20 or 21 years and by giving to the court handling the offender direct jurisdiction over the contributing agencies to his offense. (8) "Treatment of the physical ailments and incapacities of the offender is often an absolutely indispensable condition for his moral success." (9) "Educational treatment is essential for many delinquents, even though they be adults," especially by arousing healthy interests and healthy mental content. "The schoolroom, for the delinquent, should be the avenue to higher vocational possibilities, to better recreational resources, to appreciation of right methods of thinking." (10) The environment of the offender is "always to be taken account of as a formative influence, at least until the individual is thoroughly crystallized in his habits." (11) Institutions, *e. g.*, the reformatory, have a real opportunity to supply a corrective environment, now often lost through self-complacency and through lack of adequate classification of offenders and insufficient individualization of treatment. (12) "A great feature of treatment is the careful carrying over of offenders through the period of adolescent instability." (13) "A very weak point in practically all social and moral therapy is the lack of follow-up work." (14) Idiots are rarely, if ever, criminals. Imbeciles are "not at all numerous" in court cases. Morons are more important, especially because they are not, as popularly supposed, merely passive delinquents. It is impossible to lay down any general recommendation for the treatment of the moron group (save, perhaps, that they particularly need to be protected from alcohol): the individual varia-

tions in their capacities are too great. (15) "A certain number of individuals have a special, definite, innate defect in the process of self-control." (16) "If the 'moral imbecile' exists who is free from all other forms of intellectual defect he must indeed be a *rara avis*." (17) The Binet scale "is really a valuable measure of the lower general levels of intelligence" and is, within definite limits, "of the utmost practical usefulness."

By these random samples, together with the brief synopsis of the contents of the volume, I have sought to give a rough notion of the aim and treatment of Dr. Healy's work. I realize the inadequacy of this method of reviewing so compendious a study—which is, I repeat, a contribution of the first order—and I must atone for it by urging psychologists, physicians, school and court authorities and all who aim to understand better the complex and vital problems with which it deals to get acquainted with it at first-hand. G. M. W.

HENRY HERBERT GODDARD. *Feeble-mindedness: Its Causes and Consequences*. New York. The Macmillan Company, 1914. Pp. XII, 599. \$4.00.

No one has had better opportunities for extensive and intensive studies of feeble-mindedness than the author of this book. As director of the research laboratory of the Vineland, New Jersey, Training School for the Feeble-minded, he has not only made psychological studies and tests of individual cases, but has been able to repeat these studies at intervals on the same individuals, and, with the assistance of the staff of field workers, has collected a mass of material bearing on the family life of each individual that is unsurpassed in the history of psycho-pathology.

In his introductory chapter the author mentions four types of problems which call for investigation in the study of feeble-mindedness. First, there is the social problem, dealing with the prevalence of feeble-mindedness at the present time, the place the feeble-minded occupy in contemporary life, and their relation to crime, pauperism, intemperance, the social evil, incompetency, and disease. The second is the psychological problem. What sort of mental processes have the feeble-minded? How do they compare with normal individuals in the various aspects of mentality, as perception, discrimination, association, memory, judgment, and the like? Third, the pedagogical problem. To what extent can they be trained? What are the

results of the ordinary means of training? Of what moral training are they susceptible? Fourth, the biological problem. What is the cause of mental defectiveness? What is its physical basis, and what means of prevention can be suggested? The discussions in the present volume have to do primarily with the social and biological problems. The psychological and pedagogical problems are still under investigation.

To obtain reliable data regarding the family history of these unfortunates is a matter requiring no little sagacity, tact, perseverance, and discrimination. Owing to the importance of the subject, a whole chapter is devoted to an account of the manner in which the field material was collected. Chapter three constitutes the body of the book, and comprises almost four hundred pages. There are detailed reports of three hundred and twenty-seven cases. The general plan of the description of these cases is a statement of the patient's present condition, a description of his status in educational work; samples of handwriting and composition in the more advanced cases; a chart of family connections, in so far as these have been ascertained; and such general descriptive data as will contribute to a better understanding of the individual case. The cases are grouped as hereditary, accidental, neuropathic ancestry, and no assignable cause. By far the larger group is the hereditary, comprising in all one hundred and ninety-eight of the three hundred and twenty-seven cases.

This classification is not altogether satisfactory, for a study of the heredity charts and the case histories shows that many of those in the hereditary group have been victims of disease or accident, and many of the accidents enumerated are very doubtful causes of feeble-mindedness. Moreover, those cases ascribed to neuropathic ancestry have developed their present state of defect only under hereditary influences. Chapters four and five, however, which discuss the probable causes of the abnormalities described and present the data in tabular form, show that the principle of classification is a strictly pragmatic one. Those cases in whose families mental defect is clearly and strikingly manifest are classed as hereditary, those whose relatives show no feeble-mindedness, but give evidence of insanity, paralysis, epilepsy, or other pathological nervous conditions, are put in the group with neuropathic ancestry, while those in whose families no nervous disturbances are found, but whose histories show serious accident or disease (particularly meningitis) are attributed to accident. It may be, as the author carefully points out, that the neuropathic

conditions and the feeble-mindedness are both manifestations of a more subtle biological defect, while it is very doubtful whether many of the accidents assigned as the causes of feeble-mindedness are of themselves capable of producing such effects.

Throughout the discussion one can see that the author is strongly impressed by the hereditary data revealed by the field studies, and the last five chapters of the book are devoted to the systematic development of a theory of feeble-mindedness as an inherited unit character in accordance with Mendelian principles. It is true that the individual family is too small to show clearly the three-to-one relation discovered by Mendel in the crossing of hybrids, but if we add together all the offspring from similar matings (as Mendel himself did in the case of peas) and compare the actual findings with the theoretical expectation, we are at once impressed with the closeness of the agreement. But the phenomena characteristic of the development of the feeble-minded are negative rather than positive, *i. e.*, the individual develops normally, or with an approximation to the normal order, up to a certain point, then the process begins to slow down and finally comes to a complete stop, while the normal child goes on to maturity. Accordingly it would seem that normal intelligence is the positive or dominant characteristic, and feeble-mindedness is the negative or recessive aspect. In other words normal intelligence is due to a specific determiner or set of determiners in the germ plasm, while in the feeble-minded these determiners are lacking. When pure feeble-minded strains are crossed, the offspring is always feeble-minded (and for this the author believes he has good evidence), while if normal and feeble-minded strains are crossed the first generation gives no evidence of the defect, but subsequent generations approximate the Mendelian proportions.

What practical effects will such a theory have on our attitude toward the problem of feeble-mindedness? The author is not at all sanguine about the feasibility of stamping it out by legislative enactment. Sterilization, which would undoubtedly be effective if carried out consistently for several generations, meets with strong popular opposition that is so deeply rooted in the prejudices that cluster about our ideas of virility as to offer little hope of improvement. Colonization is a means of procedure that has a greater popular appeal, but we are just beginning to realize how many hundreds of thousands of feeble-minded we have in this country, and the task of segregating these in colonies is appalling. Education has been the hope of well-

meaning people for a generation, but our studies show us that the feeble-minded are educable only in certain limited directions. Rather the author finds the hope of civilization in educating people of normal intelligence to understand the nature and possibilities of the high-grade feeble-minded, to secure his protection in the kind of work he can do, to guard him against the exploitation of the evil-minded, and to utilize him as far as possible in the work of the world.

The book is a masterful presentation of authoritative data that touch upon some of our most vital social problems. Whether the distinction between normal intelligence and feeble-mindedness is sufficiently sharp and definite to warrant the author's conception of it as a unit character may well be disputed. In any case the view is stimulating and suggestive, and should give rise to further careful studies.

J. C. B.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

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EDITORIAL

In the current discussions of the reorganization of the curriculum it is encouraging to note that increasing emphasis is laid upon the arts.

MUSIC IN THE CURRICULUM

While the trend in this direction is primarily toward the practical and industrial arts, indications are not lacking that the fine arts are destined to receive more attention in the future than they have in the past. If education is to conserve and advance those forms of human activity that are ennobling and elevating and cultural as well as those that are useful and materially productive, then music, painting, and sculpture must take their place with literature as integral elements of the curriculum. For it is in these fields of effort that human nature shows its widest departure from the level of the brutes.

Most schools already devote some time to singing, and there is a pretty general provision for drawing and perhaps a bit of modelling in some of the grades. As yet, however, these subjects are regarded even by school people as extras, requiring special supervisors and in some cases special teachers, and one rarely finds a course in music, for example, in which the subject is worked out in a thorough-going and systematic manner as an essential part of the educational pro-

gram. Yet it would not be difficult to show that there is a higher educational value in a knowledge of the best musical compositions for the voice, the piano and the violin, and in the development of a critical taste for and an appreciation of good music than in nine-tenths of the arithmetic and grammar taught in the schools. Such an understanding of music is not to be developed by mere passive listening to the rendition of selections by others. If our young people are to learn to know music, they must be taught to make music. Any one who can talk and who has a reasonable tonal discrimination can be taught to sing. This capacity could be utilized by arranging the great vocal masterpieces for school use and having them learned by the children not merely as pretty pieces to be sung, but as great works of art which are worth incorporating into their own thinking.

But it is to instrumental music that we must look for much of the educative value of music study,—and this field has been almost wholly neglected by the schools. It is, therefore, a satisfaction to note that the Board of Education of New York City has recently provided that for a full year's participation in either a school choral society or an orchestra two credits shall be allowed in the second, third and fourth years of the high school course. This is still far from offering a well-organized course in instrumental music, but it is a step in the right direction. Another gratifying indication of the same tendency is the bequest of \$700,000 to the Chicago Orchestral Association the income of which is to be used in support of a public school of music in connection with the symphony orchestra. The testator expressed the hope that other gifts and bequests would be added by those who recognize "the value of a great symphony orchestra in educating the people to appreciate whatever is great and beautiful." If the public schools would now offer the pupils in the sixth, seventh and eighth grades the opportunity to learn to play some musical instruments, and would provide for more chamber music in the high school, we should make rapid strides in the realization of the educational value of music.

J. C. B.

NOTES AND NEWS

Under the title of "A School of Superintendence" a conference of school superintendents was held last June at Lincoln, Nebraska, under the auspices of the University of Nebraska and the State Department of Public Instruction. One of the principal speakers was Dr. Walter S. Monroe, of Emporia, Kansas, who gave a series of addresses on the following topics: "Measuring the Work of Public Schools," "The Application of Standards in School Supervision," "Educational Diagnosis and Remedial Instruction," and "Educational Research and its Significance to Superintendents."

Mr. W. W. Charters, of the University of Missouri, delivered a series of five lectures on Methods of Teaching before the Graduate School of Agriculture at Amherst, Massachusetts, July 3-8. Mr. W. C. Bagley, of the University of Illinois, lectured upon the Foundations of Pedagogy at the Graduate School of Agriculture during the same week.

Dr. David Spence Hill, who has distinguished himself as director of the Bureau of Educational Research, in New Orleans, was given the honorary degree of Doctor of Laws by the University of Kentucky this summer.

With the moving of the Johns Hopkins University to Homewood the psychology department will be divided. Part will be established under the direction of Professor Knight Dunlap in the academic building, while the other part, under the direction of Professor J. B. Watson and Dr. Lashley, will be moved to the psychological laboratory of the Phipps Psychiatric Clinic at the medical school. Professor Dunlap has been advanced to the rank of full professor.—*School and Society*.

During the spring the Los Angeles board of education appointed a commission consisting of Dr. Albert Shiels, director of the bureau of reference and research, New York City Schools, Professor J. F. Bobbitt, University of Chicago, and Dean Walter A. Jessup, University of Iowa, to make a study of the Los Angeles schools, and report on their future conduct. Since that time Dr. Shiels has been elected superintendent of the Los Angeles schools. Quite recently Dean Jessup was elected president of the University of Iowa.

Dr. William Frederick Book, formerly professor of educational psychology at Indiana University, who for the past three years has been on leave of absence from the University, and employed by the Indiana State Board of Education to organize vocational education in the State under the new Indiana Vocational Education Law, will return to the University next fall, as soon as the state vocational surveys now being made under Dr. Book's direction are finished and recommendations made for further developing vocational instruction in the state. At a recent meeting of the Board of Trustees, Dr. Book was appointed director of the psychological laboratory, in the Department of Sociology, the position formerly held by Professor M. E. Haggerty, and professor of educational psychology in the School of Education.

Charles H. Winslow, of New York City, will have charge of a vocational survey of Indiana conducted under the direction of the State Board of Education, the Indianapolis public schools, and the National Society for the Promotion of Industrial Education. — *School and Society*.

Mr. J. C. Brown, who had charge of the work in administration and supervision in the School of Education, University of Illinois, resigned at the close of the year, 1915-16, to accept the presidency of the St. Cloud, Minnesota, State Normal School.

Mr. W. S. Miller, who was assistant in education and secretary of the School of Education, University of Illinois, from 1912 to 1916 has been appointed to an assistant professorship in education at the University of Minnesota. He will have charge of the practice-school connected with the College of Education.

Mr. B. F. Pittenger has been appointed associate in education at the University of Illinois for the year 1916-17. During the second semester of last year he held a temporary appointment as lecturer in education at the University of Illinois.

A psychological laboratory has recently been established at Bellevue Hospital, in New York City, under the direction of Dr. Menas S. Gregory, chief of the Psychopathic and Alcoholic Services. Facilities will be provided for both clinical and research work. As these services admit about fifteen thousand patients annually, the opportunities for research will be exceptional. Dr. Leta S. Hollingworth,

formerly psychologist in the Department of Public Charities in New York City, has been placed in charge of the laboratory.

Dr. E. E. Rall, professor of education at the University of Tennessee, Knoxville, Tenn., has been elected president of Northwestern College, Napierville, Ill.

At the University of Virginia Associate Professor Hall-Quest has been made full professor of education. Professor Hall-Quest is the author of a forthcoming book on "Supervised Study" to be published by Macmillan.—*School and Society*.

Dr. Walter S. Hunter, of the University of Texas, has been appointed professor of psychology and director of the psychological laboratory at the University of Kansas.

Four graduate students of psychology have been appointed as fellows for the coming year in the Bureau of Salesmanship Research affiliated with the Carnegie Institute of Technology, as follows: Dwight L. Hoopingarner, of the University of Texas; C. P. Stone, University of Minnesota; Russell L. Gould, Columbia University; Edward S. Robinson, University of Cincinnati. In addition to these appointments, Dr. Kurt Th. Friedlaender of San Francisco has received appointment as Honorary Fellow.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

FORM BOARD AND CONSTRUCTION TESTS OF MENTAL ABILITY

W. F. DEARBORN, J. E. ANDERSON, AND A. O. CHRISTIANSEN¹

Harvard University

The tests described below are intended to be of varying degrees of difficulty of performance, and have been devised with a view ultimately of arranging them, together with other similar tests, in a graded series. Similar tests have proved very serviceable in the examination of immigrants² and native born children and adults who speak only a foreign language, in examining the deaf and dumb, and those suffering from other speech defects, and, in general, as supplementary to the series of intelligence tests originally employed by Binet and Simon.

Eight tests are described in this article: a color-form test, five essentially form board tests, a performance test, and a construction test. Some of these tests are of approximately equal difficulty and are similar to tests already described in the literature of testing. It is intended that they be used as "alternate" or equivalent tests. Such alternate tests are useful in the retesting of the same individuals, or for substitution where certain tests have become too well known from frequent use in various institutions or by various agencies.

1. COLOR-FORM TEST

This test, modeled after some of the material used in the Seguin room for the training of defectives at the Massachusetts

¹ Tests 1, 3, and 4 are devised by the first named writer; tests 2A, B, C, and D were developed by him in collaboration with Mr. Anderson; and test 5 in collaboration with Mr. Christiansen.

² Cf. KNOX. *Journal of American Medical Association*, vol. LXII, pp. 741-47.

State Institution for Feeble-minded at Waverly, consists of sixteen blocks, of which four are square, four triangular, four diamond shaped, and four circular, one of each of which is colored a bright red, blue, green, and yellow. The blocks were laid on a low table within easy reach of the child to be tested, and so arranged that no two similar figures or blocks of the same color were adjacent. The experimenter picked up a square and, indicating its shape with his forefinger, asked the child to pick up all the blocks of that same shape. The time was recorded with a stop-watch. After the blocks were replaced, the child was asked to pick out all the blocks that corresponded in color to a red figure and so on with each of the geometrical figures and colors. In the case of the figures, the child had to disregard color and attend to the form; in the cases of the colors, to disregard form and attend to color. The tests were given in the following order, square, red, triangle, blue, diamond, green, circle, and yellow.

The following table, Table No. 1, summarizes the results with this test by ages, as tried out on a few normal children.

TABLE I.
Summary, Color and Form Test

Age	Cases	Sq.	Red	Tri.	Blue	Diam.	Gr.	Cir.	Yel.	Total Time	Gen. Av.
4-5.....	10	11.4	6.9	11.4	6.0	12.5	6.6	7.3	4.6	75	8.2
6.....	7	14.7	6.8	7.8	4.5	9.0	4.1	7.0	3.5	54	6.1
7-9.....	3	7.0	7.0	5.6	3.3	4.6	4.0	3.6	3.3	24	5.2
All.....	20	11.9	6.9	9.3	5.1	10.4	5.3	6.5	4.0	153	7.4

It shows that the ability of the child to pick up the blocks increases with age, the average time for each of the eight tests with the five year old being 8.2 seconds; the six year old, 6.1 seconds; and the 7 year old, 5.2 seconds. A few children were tried beyond seven years but the test was so easy for them that its use was abandoned. In the case of every child we find that the ability to pick up the blocks increases as the test proceeds, the general average for the first block (square) being 11.9 seconds, and that for the last block (yellow) being 4.0 seconds.

From Table I it is evident that the time taken for picking up the geometrical figures is longer in every case than that taken for picking up the color which immediately follows. Comparing the times for the geometrical figures with those for the colors, we have the figures set forth in Table II.

TABLE II.

Age	Geometrical Figures	Colors
4-5.....	10.7	6.0
6.....	9.8	4.7
7-9.....	5.5	4.4
All.....	9.6	5.3

Quite uniformly it appears that the colors are picked up more rapidly than the geometrical figures, indicating that at these ages, the child's sense of color is much better developed than is that of form. With the increase in age, there is a great increase in the ability to pick up the geometrical figures; from 10.7 seconds for the 4-5 year olds to 5.5 seconds for the 7-9 year olds, while in the case of the colors the increase is relatively slight (from 6.0 seconds for the 4-5 year olds to 4.4 seconds for the 7-9 year olds)—a difference which might be accounted for on the basis of greater ease of movement rather than an actual difference in the time of discrimination. The 6 year olds pick up the colored blocks on an average in 4.7 seconds while the 7-9 year olds take 4.4 seconds, a difference so slight as to indicate no difference in discrimination. On the other hand the 6 year olds take 9.8 seconds for the geometrical figures and the 7-9 year olds take but 5.5 seconds, indicating that the ability to discriminate simple forms becomes clear cut shortly after the sixth year. In the case of the 7-9 year olds the difference between the geometrical figure time and the color time amounts to only 1.1 second, the first being 5.5 seconds, the second 4.4 seconds, whereas the corresponding difference in the case of six year olds is 5.1 seconds. All of these statements are, of course, subject to modification on the basis of a larger number of cases. They are given here in order to indicate concretely the sort of comparisons which it will be of particular interest to make on the basis of fuller returns.

2. FORM BOARD TESTS

The Seguin form board, or the modification of it used by Norsworthy, Goddard, and others, has in the experience of many investigators proved very serviceable, being particularly useful in the differentiation of the low grade feeble-minded. Similar tests, but of somewhat greater difficulty, are desirable for use with the higher grade cases. The first board (Form Board 1A, see Figure 1) proposed for this purpose was made by selecting

four of the forms originally employed by Seguin, two of each or eight in all, and cutting the blocks in halves in two different directions, i. e., lengthwise and crosswise. This makes a somewhat more difficult test than the original one of Seguin. Form board 1B (not shown here) made use of quarter blocks, but this change was found not to add materially to the difficulty of the performance, and was, therefore, early dropped from the group of tests. Form boards 1C and 2 made use of the principle of reconstruction, as will be described more in detail below.

FORM BOARDS 1A, 1C AND 2

Board 1A consists of four pairs of depressions. In one of each pair blocks cut once lengthwise are to be fitted, and in the other blocks cut once crosswise. (See Figure 1.) In our tests, this form board was given to the child after he had completed the Goddard modification of the Seguin Board, with instructions "I have another board for you now, much like the other one, except that there are two blocks to go in each hole." Both holes and blocks are numbered as in the accompanying diagram. Incorrectly placed blocks or errors are recorded thus 4-5 indicating block four was tried in depression 5.

For form board 1C certain of the blocks (some quarter blocks being used) were so placed in the depressions that the child had to shift some of the blocks already present and place in the depressions other blocks lying at the side of the board. When the test is completed all the depressions on the board are filled. The diagram (in Figure 1) illustrates the arrangement of the board and the extra blocks which fill the depressions.

The test was given after test 1A, the blocks being rearranged as shown in Figure 1, 1C, the four extra blocks being placed at the top of the board. The directions were simply: "You are to fill up all of the holes. You may change the blocks around as you need to." This test as well as Test 1A is now being standardized. The results of the first seventy children tested, arranged somewhat arbitrarily in groups of three years each, will give an indication of the time differences. The tabulation of failures and of errors made has not yet been carried out. It will probably furnish a better basis for differentiation than the time factor.

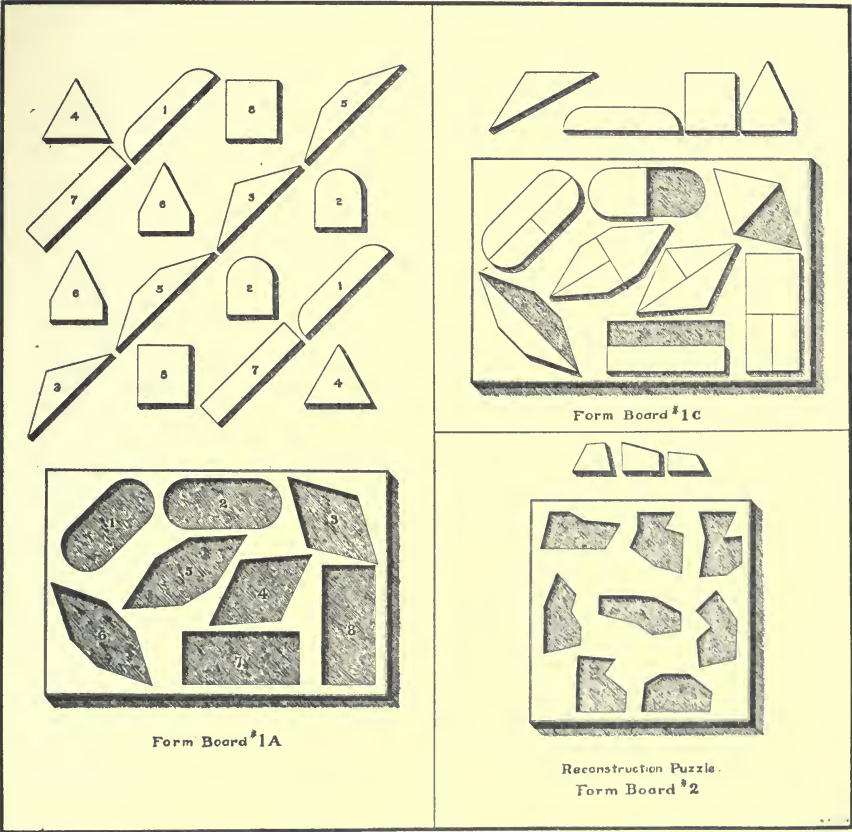


Figure 1

(Shaded parts of boards are intended to represent depressions)

AGES 5, 6, AND 7 (GROUP OF 15 CASES)

Median score, 225 seconds, that is, one half of the group do the test in less than 225 seconds. One third of them do it in less than 190 seconds. The lowest score made was 86 seconds; highest, 521 seconds.

AGES 8, 9, AND 10 (GROUP OF 28 CASES)

Median score, 175 seconds, that is, one half of the group do the test in less than 175 seconds. One third do it in less than 145 seconds. Lowest score, 67 seconds; highest (with one exception clearly out of group), 395 seconds.

AGES 11, 12, AND 13 (GROUP OF 27 CASES)

Median score, 125 seconds. One third of group do test in less than 100 seconds. Lowest score, 31 seconds; highest (with one exception clearly out of group), 334 seconds.

FORM BOARD 2 OR RECONSTRUCTION PUZZLE

This consists of a board containing eight irregular depressions and three blocks which will fill each of the depressions. The blocks consist of unequally sided trapeziums with their sides in the relation 2:3:4 with one extra side of 2, 3, and 4, respectively.³ The child was asked to pick up three blocks and fill the first depression, then to take out the blocks and fill the second, and so on, through the eight depressions. Time was taken on each depression with a stop-watch.

The following directions were given for the use of the board: Place board before child as before, covering it with cardboard. Place the three blocks in his hand, saying, "Here are three blocks which fit nicely into each one of these holes." If child tries to crowd or force blocks in, say "They will go in easily if you get the right places. You do not need to force them in."

As the child finishes one hole, point with a pencil to the next in which he is to fit the blocks. Always have him proceed from left to right along the top row, then along the second row, then the two holes in the third row. The board should be placed so that the straight or base line of the central figure is toward the subject.

Record the time on each hole and general manner of procedure. There is opportunity for listing errors.

Allow three minutes for first hole. If not done in that time, put blocks in before subject and remark how well they fit in. If no successful placement is made on second hole in two minutes count as failure and proceed to next hole.

³ These forms were adopted at the suggestion of Mr. Herbert Sturgis, a graduate student in psychology at Harvard University.

A code of signs was prepared for noting rapidly differences in the mode of doing test, and differences in the grade of error. The following are some of the differences to be noted: "very noticeable" or "gross error," "mere turning of blocks about," "removal of a correctly placed block," "continued repetition of same error" or "neglect to change a bad placement," "systematic trial of each of the three blocks in turn," etc.

In our earlier tests an arrangement of this board was used, which is referred to as the Old Reconstruction Puzzle. Later, on the basis of these results, the order of the depressions was shifted, the shape of the depressions themselves however not being changed. Results with this newer form are listed under the heading, New Reconstruction Puzzle.

This test was much too difficult for the majority of the younger children. It is only rarely that a child under ten years of age is able to fill all the depressions. One or two may be accomplished at an earlier age but usually the problem is too complicated. The variability of performance is, however, very great; several adults, graduate students, failed to complete one or more of the forms within the limits of time which have been set for doing the test. This great variability will probably make it necessary to give up the test for general use, or to modify it in some way.⁴

It was thought that this test would give a measure of the student's ability to profit by practice and experience. The following two tables give the average time for each of the depressions in the older and newer form of the Reconstruction Puzzle for the various age groups. It will be seen that in both Puzzles there is a gradually decreasing average time as the depressions are gone through successively. This decrease is subject to marked exceptions indicating that some of the depressions are proportionately more difficult than are others.

In order to have a basis of comparison with a standard test the subject was first tested with the Seguin-Goddard Form Board, the procedure being similar to that used by Sylvester. The

⁴One cause of variability is that different faces of the blocks must be uppermost in the various holes, i. e., the blocks must be turned over in order to fit into all the holes. To obviate this, a board is now being tried out with but four forms, namely numbers 1, 5, 7, and 8, which last has been somewhat altered so that the same surfaces are used as in the other holes. Knobs have been added to the blocks, so that they will not be turned over.

TABLE III.

Summary of Old Reconstruction Puzzle by Ages

Age	Cases	1	2	3	4	5	6	7	8	Av.
5-6.....	3	97.5	110.5	237.3	91.0	150.0	80.0			129.8
8-11.....	5	97.0	83.8	71.4	204.4	63.6	76.2	27.8	67.2	86.4
12-14.....	12	52.9	102.0	72.0	82.1	34.8	57.6	19.4	40.7	57.7
Adult.....	13	55.1	54.7	42.4	32.4	49.3	27.3	17.3	20.0	37.3
All.....	32	65.5	82.2	75.3	81.7	55.3	49.6	19.8	36.1	58.9

TABLE IV.

Summary of New Reconstruction Puzzle by Ages

Age	Cases	1	2	3	4	5	6	7	8	Av.
4-7.....	3	162.0	118.3	69.0	90.0	147.0	53.5	11.5	68.0	97.8
8-9.....	5	103.1	117.0	94.2	136.2	100.7	35.0	33.3	63.0	95.9
10-11.....	10	82.5	53.0	42.4	54.7	55.3	46.2	37.3	35.4	50.8
12-13.....	8	40.1	92.1	49.3	61.8	27.2	90.5	73.0	87.5	66.3
14-16.....	4	82.0	68.0	24.5	55.0	29.5	32.7	37.7	15.2	33.1
All.....	30	86.1	81.9	53.5	72.6	54.6	57.8	45.6	54.0	63.8

TABLE V.

Relation of Depressions on Older Puzzle to Those on Newer Form

Old.....	1	2	3	4	5	6	7	8
New.....	7	5	6	4	8	3	1	2

subject was then given Test 1A and Test 1C on the same board, and finally the Reconstruction Puzzle. In the case of the younger children the Color and Form Test was given before the Seguin-Goddard Form Board. The children used in these tests were from three schools, an Open Air Kindergarten in Cambridge, the Bigelow School in Newton, and the Fletcher School in Cambridge, Massachusetts.

Throughout all the tests ability increases with age. In the case of the Color and Form Test, the Seguin-Goddard Form Board, and the 1A Board, this increase proceeds by somewhat equal steps from year to year. In the case of the 1C arrangement and the Reconstruction Puzzle the steps are more variable.

QUALITATIVE REACTIONS

As noted above, the errors made have not yet been tabulated, but in general it may be said that with performance tests errors show themselves in an increased time. Certain errors were so noticeable as to deserve especial mention. In the case of the Seguin (Goddard) Form Board the six year old children had

difficulty with the diamond and hexagon, confusing one with the other, and often trying to place one in the wrong depression.

This error transferred itself to the 1A board where it was evident among much older children, being common up to nine years. Where the blocks are split longitudinally, the child must have a clear idea of form to be able to keep the half diamond and the half hexagon distinct.

In the case of the Reconstruction Puzzle errors were made in confusing the angles. All the children proceeded largely by trial and error in handling this puzzle although there were a few noticeable exceptions.

As to general procedure in the case of the 1A board, two types were noticed. Some children took the blocks in order and placed them in the depressions in which they thought the blocks belonged. Others realizing that it took a pair of blocks to fill the depressions, deliberately sought for the other block as they picked up the one. These two types of procedure seemed common to all ages and bore little or no relation to the time taken for the test. Some children paired the blocks in the air before placing them in the holes, but most of the children placed the blocks directly. As a rule the child who pairs blocks in the air had the clearest idea of form and made a good record. In the higher ages, the forms were so evident to the children that little pairing or planning was noticed.

In standardizing these tests, especial attention should be paid to the kinds of errors and to the methods of procedure which are evidently of much value for diagnostic purposes.

FORM BOARD 3

Some ten years ago in connection with a series of experiments on motor ability, the first named writer of this article arranged a "block" test for use with defective children with the same purpose in mind as in the case of the above described series of tests; namely, that of arranging a more difficult performance test than the Seguin form board, but one of essentially the same sort. The "block test," as then used, is illustrated in Figure 2.⁵ This block test was described to Drs. Healy and Fernald and was

⁵ Figure 2 is reproduced from Plate VI of a thesis by L. H. King on "The Validity of Motor Tests of Mental Efficiency," submitted for the Degree of Master of Arts at the University of Wisconsin, in 1906, and on file in the University Library.

BLOCK TEST

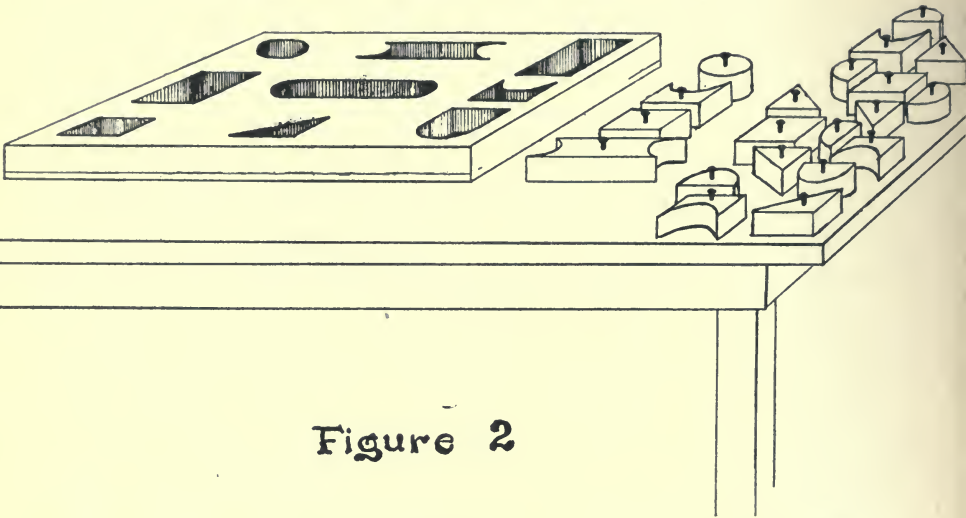


Figure 2

adopted by them with modifications, as published in the Psychological Review Monograph Series, volume XIII, no. 2 (Figure 8), for use at the Psychopathic Institute in Chicago.

The modification used by Drs. Healy and Fernald is subject to certain criticisms which do not apply to the original board, or at least with equal force. These considerations have led to the preference of the original board in connection with the present proposals for a graded series of tests.

The chief criticism of the Healy-Fernald board is that several placements which at the time of making are not recognized as errors without a considerable amount of prevision on the part of the subject are nevertheless errors, and must be corrected; whereas, other placements, which to the superficial observer may appear to be no better, lead without error to the solution of the problem. This makes it possible for one individual by good luck to complete the test with little difficulty, whereas another person with equal ability, or the same individual in repeated trials, may follow the first indicated course, and have a harder

problem to solve. This explains in part the large variability of performance in this test. It is essential that exactly the same problem be presented to each subject and this is not possible when a chance placement can affect the result in the way just indicated.

Because of the larger number of possible methods of solution, due to the greater interchangeability of the blocks, this difficulty was minimized in the original board. It is further lessened in the methods proposed for the use of the board, which consists in presenting a problem of varying difficulty, the subject being required to fill the empty spaces with the fewest possible number of moves.

Four "problems" of increasing difficulty are shown in Figure 3, a, b, c and d.⁶ For example, the problem in Figure 3a is to prepare a place for the square (at the top of the board) by making as few as possible changes of the blocks as placed—in this case two, requiring in all three separate movements to complete the test. In 3b, places for two squares must be made, etc. The test when done in one's mind is, of course, more difficult than when done with the blocks.

3. A "TRIANGLE" PERFORMANCE TEST

In this test the chart shown in Figure 4 is placed before the subject and two right-triangle blocks are placed in his hand. He is asked to make the figures in the chart in the order indicated, and, in general, with as few moves as possible. The test may be repeated several times to note practice effect. The fact that the chart presented is smaller than the blocks makes direct superimposing impossible, and increases the difficulty of the test. It is intended primarily as an "alternate" test.

4. CHAIR CONSTRUCTION TEST⁷

The parts of a small rocking chair are presented to the subject arranged in the order illustrated in Figure 5, with the instructions, "See if you can make a piece of furniture out of these pieces. You must use all the pieces." The parts are intentionally so made that several of them are interchangeable, *e. g.*,

⁶ In the board, as now used and here illustrated, a trapezoid figure has been substituted for the triangle of the original board.

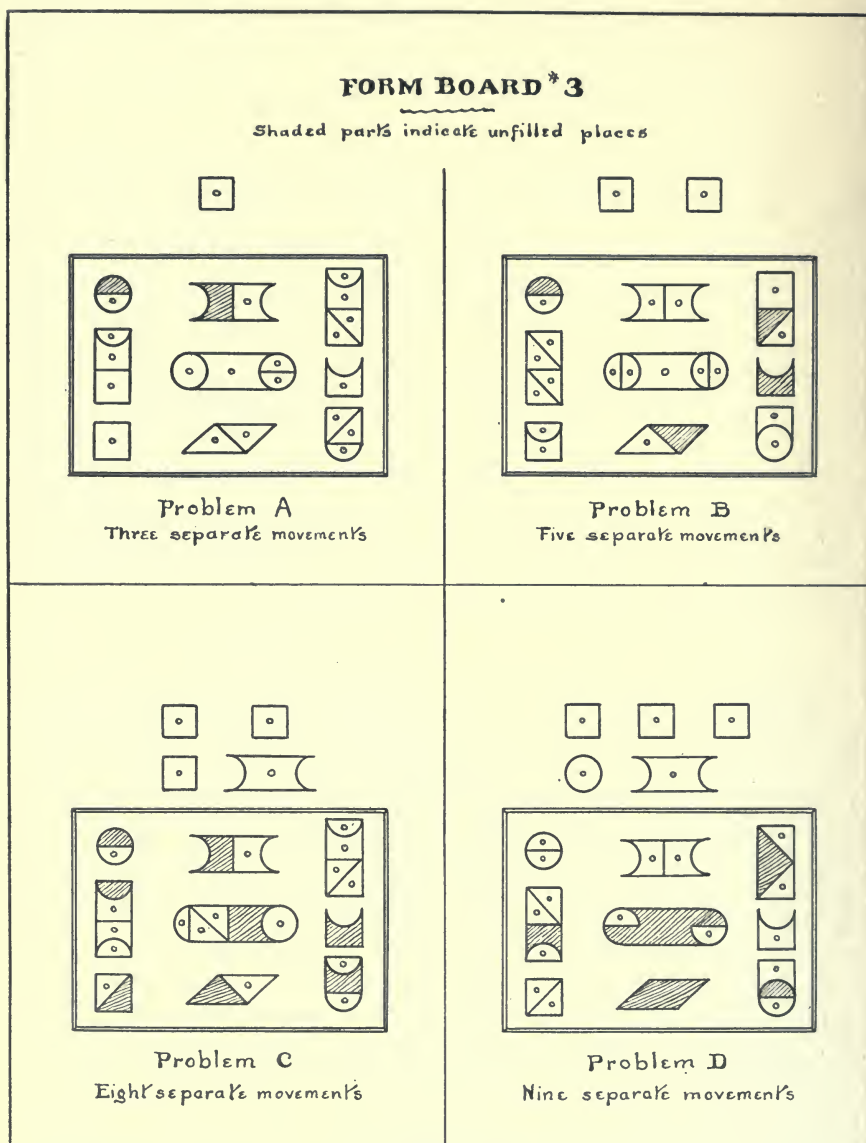


Figure 3

A "TRIANGLE" PERFORMANCE TEST

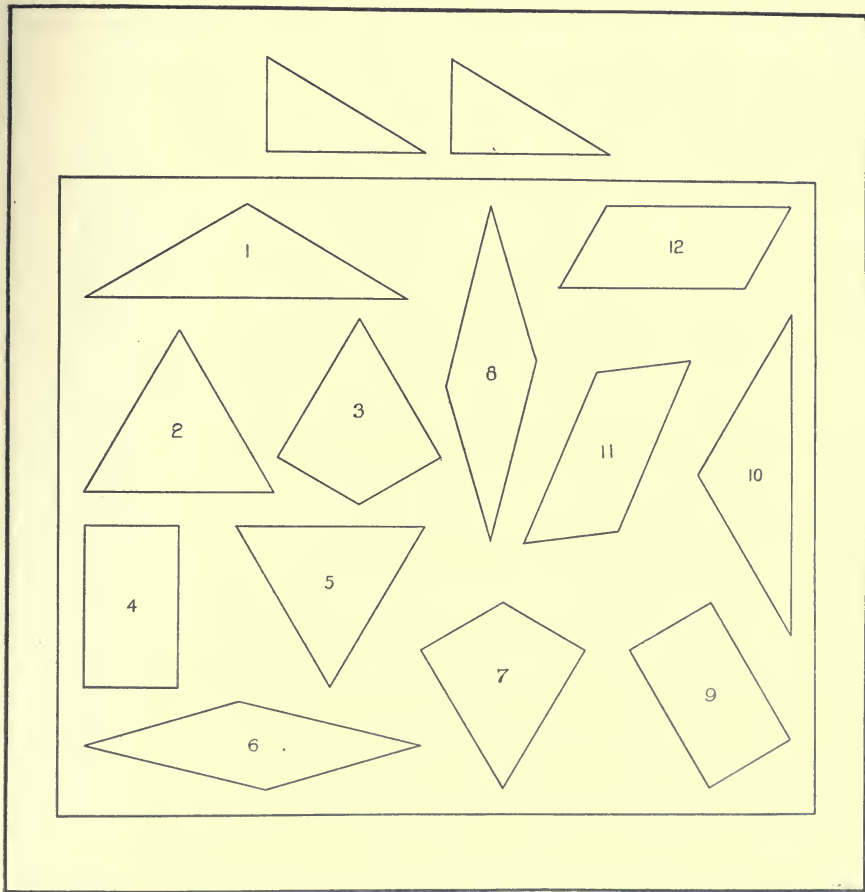


Figure 4

the top piece of the back of the chair *can* be fitted as one of the runners of the chair; it will not; then, however, match the other runner. It is further necessary, of course, to choose four pieces of equal length for the legs of the chair, although others will fit, etc. When the pieces are mounted on a board, as illustrated, the subject may be asked to do the test mentally, that is, in his "mind's eye." This, of course, increases greatly the difficulty of the test.

⁷ For much more elaborate developments of construction tests, see Truman L. Kelly, in this JOURNAL, for January, 1916, which article appeared since the above described test was devised.

The apparatus and test materials described above may be secured from the Mechanician of the Psychological Laboratory, Emerson Hall, Cambridge, Mass.

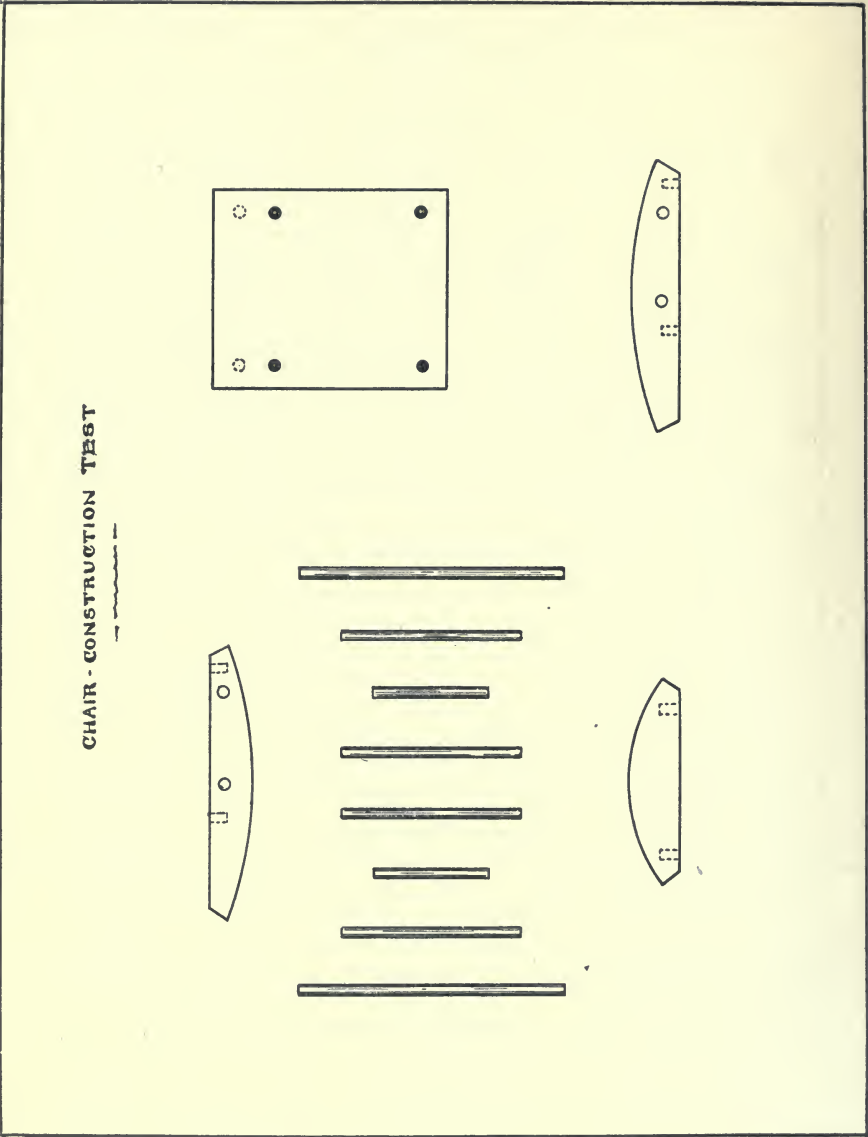


Figure 5

A TENTATIVE STANDARDIZATION OF CERTAIN "OPPOSITES TESTS"

IRVING KING AND HUGO GOLD

University of Iowa

Among the various mental tests the tests of ability to give opposites has found much favor with a number of investigators. Such tests are supposed, if the words are easy, to measure, in some degree, the rapidity of controlled association reactions; if the words are hard, including such words as "unless," "suave," "ignorant," etc., the tests measure in some degree logical keenness in selecting the word which will express most nearly the contrary idea.

Of the most prominent experimenters who have used "opposites tests" may be mentioned: Thorndike, Wells, Norsworthy, Simpson, Hollingworth, Chapman.¹ While such tests have been frequently used it is doubtful if the results thus far obtained are fairly comparable. This is partly because of different methods of scoring, partly because of lack of uniformity in giving the tests, and partly because of different standards of determining correct response words.

The usual method of giving opposites tests has been to give the subject a printed list of words and at a given signal have him write the opposites of the words occurring on the printed list as rapidly as possible. This method is open to the objection that there is so much difference in the rapidity with which different subjects write and the test, thus given, becomes not only a test in controlled association but also a test of speed writing.

Tests of this character have often been given in classes or groups with a time restriction but the very fact that there is competition, the subject being conscious that he is being "timed," causes him to act in an unnatural way. While many subjects do better under pressure of this kind, many others do not do so well.

Even when given under the best of conditions, opposites can be said to test only a certain type or phase of mental ability.

¹ A summary of results thus far attained from the various opposites tests is given by Whipple in his *Manual of Mental and Physical Tests*, Part II, 79-88, and therefore no attempt is made to summarize previous work.

Lack of ability to measure up to a certain standard in the naming of opposites may not mean that the subject is mentally deficient; it simply means that he is deficient in a particular field of mental attainment. We do not mean to imply that opposites are elemental tests, signifying by this term that they test one and only one mental function; neither do we contend that, taken alone, they are an adequate test of mental efficiency; but taken in connection with other tests, opposites properly standardized, we believe, may prove a peculiarly valuable help in measuring mental ability.

Statement of Problem: The object of the present study was to take certain lists of words which have been used by various experimenters for "opposites tests," to give these tests under the best possible conditions, and to attempt to standardize a list or lists from which one may expect reasonably uniform results, (when given under like conditions); and, furthermore, to standardize the grading of opposites tests by determining the words likely to be given as the opposite of each word, their frequency and their relative values. Tables of frequency of various response words with their values should enable different investigators using these tests to grade them according to a uniform standard, something which heretofore has been altogether impossible. We have selected for our present purpose eight lists of twenty words each, four lists of easy opposites and four lists of hard opposites.

These eight lists of stimulus words were used by Simpson² in connection with other tests given to thirty-seven subjects. According to Simpson the easy opposites test "rapidity of association" while the hard opposites are a test in "selective thinking."

Method of Giving the Tests: In the present study the tests were given to one hundred subjects including nine faculty members, twenty-three graduate students, forty-seven seniors, and twenty-one juniors, all of the departments of education and psychology in the University of Iowa. The method of giving them was as follows: The subject was given printed lists of the words with the following instructions: "Here are eight lists of words. Four of the lists contain simple, familiar words, while four contain more difficult words. You are to take one list at a time, go down the list and name orally the opposite of each word in rapid succession; e. g., if the word 'good' occurs say 'bad.' Wherever possible,

² B. R. Simpson. *Correlation of Mental Abilities*. Teachers' College, Columbia University. Contributions to Education, No. 53.

avoid prefixing a syllable to the stimulus word, but try to get a different word; *e. g.*, if the word 'like' occurs it is better to say 'dissimilar,' not 'unlike.'"

After being satisfied that the subject understood what he was to do the experimenter gave the signal to begin and the time was taken on each list separately with the stop watch and the responses were recorded in shorthand. Very few subjects needed further instruction, but in case a subject did not fully understand, additional instructions were given after the first list had been completed. Every effort was made to give the tests under uniform conditions and to eliminate everything that would hinder normal reactions.

The value of verbal reactions and shorthand records is obvious. It was desired to secure an accurate determination of individual differences in giving opposites uncomplicated by individual differences in speed of writing. In some cases where the tests have been used the verbal reactions alone were taken, the observer noting, as the opposites were pronounced, whether they were right or wrong. It is clearly impossible for this to be done in other than in a very rough way except in the case of easiest words. A part of our problem was the careful valuation of the response words both for the purpose of working out a standardized method of grading for future use and also for the purpose of determining more exactly the individual differences and correlations in the case of our own subjects.

The method of shorthand records, while desirable in general and frequently possible, cannot always be followed by the investigator. It was especially necessary for our purpose which was primarily, as we have said, to tabulate and value the most common reactions to these words. With such a table at hand it should be possible for future users of these opposites tests, following our rules of grading, to secure much more nearly comparable results than have been hitherto possible.

Criticisms: It was observed that all subjects did not set up the same standards of speed and accuracy. Some subjects sacrificed accuracy for speed and *vice versa*. Some would strive for absolute accuracy while others apparently gave the first word which occurred to them. In many cases subjects were told that some of the words do not have absolute opposites.

There was a slight tendency for the subjects to repeat the stimulus word without giving an opposite. This was only true on the easy lists, for, in the case of the hard lists, subjects were instructed

to pronounce the stimulus word and then give the opposite. The tendency to give synonyms was quite marked.

Tabulation of Results: A complete tabulation of all reactions to the 158 words³ in these tests is given in the appendix. The numbers at the left of the words indicate the frequency with which each word was given by our one hundred subjects. Since there were exactly one hundred subjects these frequencies are also percentages.

The scoring of these reactions is indicated as follows: All underscored words were considered correct. In the four lists of easy opposite reactions all words having the fraction $\frac{1}{2}$ added were given one-half penalty. Other words were given full penalty. In the four lists of hard opposite reactions, the words followed by (2) were given one-third penalty that is were regarded as $\frac{2}{3}$ correct and those followed by (1) were given two-thirds penalty or were regarded as $\frac{1}{3}$ correct. All other words and omissions were not only given no credit but were penalized by a definite amount as explained in the rules which follow.

BASIS FOR GRADING OPPOSITES

General Rules

Grading was more or less arbitrary but consistent.

It was clearly recognized that some words do not have absolute opposites.

Opposites were determined on the basis of antithesis, degree, presence or absence, exclusion, etc.

Recognizing these different points of view in determining opposites, we often allowed two or more words equal value as the opposites of a given word.

It was difficult to formulate a set of rules for grading that would apply with equal force to all cases. A critical and analytic examination of the lists of opposites given reveals the fact that the English language, as commonly used, is unscientific, inconsistent, and in many instances inflexible and incapable of expressing fine distinctions.

In formulating these rules no claim is made for scientific precision, and it is recognized that they might be improved. The purpose here was to adopt a few principles as a working basis, and

³ Two words occurred twice in the easy lists used by Simpson and in these tests. There should have been 160 words.

there was no attempt at greater accuracy than the conditions seemed to warrant.

In view of the fact that the easy opposites were more of a test of rapidity of reaction and association time, and not so much a test of vocabulary, general knowledge, capacity for selective thinking, and the like, it was thought best to make separate sets of rules for the easy and the hard opposites.

Rules for Grading Easy Opposites

The penalty for an omitted word was four seconds.

Exact opposites were given full credit.

If the word had no exact opposite one or more words were selected as the nearest opposites and given full value.⁴

A second class of words of opposite meaning, but not so good as a first class word were given one-half credit.

In doubtful cases, the rank of a word would be determined by asking the question, Does the word have a better opposite than this one? If it appeared that it did, the word in question would be given $\frac{1}{2}$ credit.

Rules for Grading Hard Opposites

If the subject omitted a word, *i. e.*, passed over a stimulus word without giving any response at all, or if he gave a fourth-class word, a word entirely wrong, he was penalized eighteen seconds, this much time being added to his total score.

Words were ranked according to the following rules:

1. A certain word, or group of words, were selected from the responses as correct opposites, or of equal value to opposites, of a given word and were given full credit.

2. Another class of words was ranked at two-thirds of the value of an opposite, consisting of (a) any word which appeared to be closely allied to an opposite but itself having a better opposite than the stimulus word, (b) words that in popular parlance or careless speech are sometimes used as opposites, (c) in a few cases a phrase of common usage if it expresses an exact opposite idea; *e. g.*, *tardy* = *on time*, (d) two words well chosen if the one is used to make an opposite more emphatic; *e. g.*, *sleepy* = *wide awake*.

⁴ A tentative grading of all the opposites was first made Mr. Gold who gave the tests, then the grading was thoroughly gone over and discussed with Professor King, under whose direction this study was made. Several changes were made in this second grading. Then a third grading was made by Professor M. A. Shaw, of the department of English, some additional changes were made, and the reasons for such changes were discussed with Mr. Gold and Mr. King.

3. A third class of words were ranked at one-third of the value of an opposite: (a) word of a remotely opposite signification, (b) the opposite idea, but a different part of speech, (c) a regular, well-worded phrase of common use if it expresses the opposite idea, or a nearly opposite idea.

4. Fourth-class words were given no credit, being classed as omitted words and penalized the full eighteen seconds: (a) synonyms, (b) the stimulus word repeated, (c) random words with no opposite signification, (d) coined words, (e) irregular phrases.

RESULTS

The Determination of Standard Tests of Nearly Uniform Difficulty.

The only definite attempt thus far to standardize the opposite tests is that of Dr. Wells, *Association Tests*, reported in Psychological Review Monograph Supplement, Vol. xiii, No. 5, 1911. With especial reference to the easy opposites he contends that the various lists which have been used contain unequally difficult stimulus-words. Wells has suggested that in order to be of the most value in securing uniformity of results the words should be of about the same degree of difficulty. He has at least suggested a step in the right direction, namely, along the line of standardization. He has made up several lists which he claims to be equally difficult, one of which follows:

High, heavy, up, worse, few, true, east, wrong, wet, asleep, after, sick, smooth, early, large, open, good, weak, long, glad.

It is quite evident that Wells' lists are not fully standardized. Thirteen of these words occur in the lists used by the writer, with the results shown in the following frequency table:

Heavy	98 light,	1 thin,	1 unheavy	
High	98 low,	1 short,	1 high	
Up	95 down	1 below,	1 deep	
	1 high,	1 low,	1 in	
East	100 west			
Wrong	95 right,	2 good,	1 correct,	1 bad
Wet	100 dry			
Asleep	100 awake			
After	99 before,	1 later		
Sick	85 well,	12 healthy,	1 unhealthy,	2 ill
Open	57 shut,	40 closed,	2 close,	1 wide
Good	98 bad,	1 worse,	1 poor	
Weak	96 strong,	1 slow,	1 healthy,	1 old,
Glad	40 sad,	21 unhappy,	19 sorry,	2 mad
	3 sorrowful,	1 melancholy,	1 miserable,	1 omitted

From the above it appears that Wells is not wholly right in his expectation of uniform results from the lists which he proposes. If he should leave out the words *sick*, *open*, and *glad* he could reasonably expect fairly uniform results from the other ten words.

On the basis of our results, we offer, as standardized lists, certain words selected from our frequency tables which ought to give fairly uniform results in an opposites test, when given under standard conditions.

The two following lists of easy stimulus words consist of only those words to which ninety per cent. or more of the subjects gave the correct opposites:

good	up
outside	wet
quick	new
white	soft
light	wrong
rich	yes
empty	young
war	winter
many	weak
hot	forget
dirty	wild
heavy	straight
late	love
left	day
near	asleep
north	brother
in	buy
east	come
something	broad
high	dead

The following list of twenty-five words was selected from the four lists of hard opposites as being the most difficult. In each case the accuracy of response was less than 69%. The words are given in their order of difficulty.

deceitful ⁵	58	animated.....	47
ignorant.....	58	clumsy.....	47
exciting.....	56	disastrous.....	45
motion.....	55	venturesome.....	44
sinful.....	54	haughty.....	43
weary.....	54	suspicious.....	40
rigid.....	53	serious.....	40
impoverish.....	51	precise.....	31
proficient.....	51	unless.....	22
genuine.....	51	pride.....	21
result.....	50	forceful.....	20
grand.....	50	suave.....	20
imaginary.....	49		

⁵ The numbers following the above words indicate the percentages of accuracy of our one hundred subjects in responding to these words.

Some of the easier words of the hard list do not differ very much in difficulty from the words given in the easy lists and the question might well be raised as to whether these words should be ranked as really hard stimulus words. What is actually needed is a series of lists of graded difficulty passing from these which are the easiest of the hard lists to the hardest of all. Such graded lists can easily be constructed from our frequency tables of reactions given in the appendix.

Since these frequency tables have been made they have been tested out in the grading of reactions of other subjects and it has been found that while reactions are often made which are different from those tested here, our lists prove to be reasonably complete and, in cases where different words are given, they can nearly always be readily evaluated on the basis of the lists here given.

Observations on the Performance of Individual Subjects

In giving the tests the following tendencies were noted: Notwithstanding the fact that subjects had been instructed to the contrary there was a persistent tendency to add a prefix to the stimulus word.

Probably due to the fact that the subjects were desirous of making a good time record, the pressure thus added caused many to coin words or to use a slang word or phrase when the opposite word did not suggest itself readily.

In the easy list there was a slight tendency to repeat the stimulus word instead of giving an opposite.

Among other tendencies which were observed, may be mentioned the following:

To give for the opposite, a synonym of the stimulus word.

To give a near opposite but a different part of speech.

To give an opposite which had been previously given.

There were found to be 186 instances of synonyms given for opposites out of a total of 16,000 reactions. These were nearly evenly divided between the sexes.

On the basis of the tests, tables were prepared giving the original times of each subject for each list of words, the total penalties for errors and omissions, the scores for each subject on each list obtained by adding the penalties to the original times, and the total scores for each subject, first for the four lists of easy words

and secondly for the four lists of hard words. These tables are not here reproduced, but persons wishing to see them may have them on request.

The penalties alone furnish good measures of the individual differences in accuracy in the different subjects. A comparison of the penalties with the original time scores enables one to determine whether there is any relation between speed and accuracy in such a test as this. In order to make such a comparison the 100 subjects were distributed into groups according to the penalties given for errors and the average time taken by each group was computed. Table I gives the results for the easy lists of words.

TABLE I

Cases	Penalties	Average times (Seconds)
4	0-10	116
16	11-20	114
30	21-30	132
26	31-40	166
16	41-50	137
4	51-60	139
2	61-70	162
2	71-80	148

Average time of the best 50 in the giving of easy opposites.....123 seconds

Average time of the poorest 50 in the giving of easy opposites.....135 seconds

Table II gives similar results in the case of the hard lists of words.

TABLE II

Cases	Penalties	Average times (Seconds)
1	150-200	275
1	201-250	369
12	251-300	303
15	301-350	299
12	351-400	326
17	401-450	352
13	451-500	333
8	501-550	364
7	551-600	447
4	601-650	355
5	651-700	382
2	701-750	435
1	846	264
1	1564	518

Average time of the most accurate 59.....315 seconds

Average time of the least accurate 41.....316 seconds

It will be seen from these tables that there is a slight correlation between speed and accuracy in the case of the easy lists but that in the case of the hard lists the time taken by the more accurate is practically identical with the time taken by the less accurate.

In the following table are given the median scores and the ranges of the grades made by the different groups of subjects.

TABLE III
Easy Opposites Tests

	Cases	Median scores	Range of scores
Faculty.....	9	139	119-161
Graduates.....	23	158	93-236
Seniors.....	47	166	104-200
Juniors.....	21	179	117-266
<i>Hard Opposites</i>			
Faculty.....	9	679	437-769
Graduates.....	23	668	496-1571
Seniors.....	47	786	477-1276
Juniors.....	21	843	472-1110

In the case of the easy lists it will be noted that there is a definite correlation between scholastic ranks and ability in these tests. In these lists correlation is not so marked for the median standing of the faculty is slightly inferior to that of the graduate group.

Taking the ranks of the one hundred subjects on the easy lists and comparing them with their ranks on the hard lists we find that fifty per cent. of the subjects gain an equal or better rank in the latter lists.

A VOCABULARY TEST

As supplements of the study of opposites two additional tests were given, a *vocabulary* and an *information test*. The question was raised as to whether the ability to give opposites readily is related to range of information and vocabulary index. As may be seen from the following there appears in our subjects to be a positive correlation in both cases, but the highest with the range of information.

The tests used were the blanks described by Whipple containing one hundred test words each. It was possible to give these tests to only fifty-one of the subjects of the first tests. No close check was made upon the extent to which these subjects over-estimated their knowledge. There should have been an accompanying definition check. The following Pearson coefficients were obtained:

Hard opposites with Information.....	.40
Hard opposites with Vocabulary.....	.19
Easy opposites with Information.....	.37
Easy opposites with Vocabulary.....	.16
Information with Vocabulary.....	.45

SEX DIFFERENCES

A slight sex difference was noted in the responses. There were 41 men and 59 women. The men were mostly of a higher scholastic rank than the women, 8 of the men belonging to the faculty and 18 being graduate students, while the women were nearly all undergraduates.

The average time and the average penalty of the men and women is given separately in the table below.

TABLE IV

Easy Opposites

	Average time to complete the four lists	Average penalty for errors
Men.....	136 seconds	31
Women.....	169 seconds	44

Hard Opposites

Men.....	357 seconds	427
Women.....	296 seconds	453

It will be seen that the women were less accurate than the men but they were less mature and less advanced in scholarship.

APPENDIX

FREQUENCY TABLES OF RESPONSES

Easy Stimulus Words and the Responses of 100 Adult Subjects

The *italicized* words were given full credit, those marked $\frac{1}{2}$ received one-half credit and the remaining words were given no credit. The frequency of the response words is indicated by the numbers at the left. The numbers at the right of the stimulus words indicate the percentage of accuracy in the responses, or the relative difficulty of the various words.

ABOVE	94	80 <i>below</i> 13 <i>under</i>	1 <i>beneath</i> 2 down	1 top 1 high	1 lower 1 omitted
ABSENT	89	78 <i>present</i>	22 here $\frac{1}{2}$		
ASLEEP	100	100 <i>awake</i>			
BACKWARDS	94	65 <i>forwards</i> 29 <i>forwards</i>	4 frontwards	1 in-front-of	1 omitted
BEGINNING	90.5	46 <i>end</i> 42 <i>ending</i> 2 closing $\frac{1}{2}$	1 final $\frac{1}{2}$ 1 finish $\frac{1}{2}$ 1 finishing $\frac{1}{2}$	2 stop 2 last	1 finished 1 omitted 1 commencement

BEST	78	68 <i>worst</i> 20 poorest $\frac{1}{2}$	5 poor 4 bad	1 oldest 2 omitted	
BIG	72	45 <i>little</i>	54 small $\frac{1}{2}$	1 large	
BRAVE	51.5	24 <i>cowardly</i> 1 <i>squaw</i> 35 coward $\frac{1}{2}$	7 afraid 7 timid 1 fearful	1 scared 1 scary 1 cowardice	12 omitted
BROAD	93	93 <i>narrow</i>	1 rough	1 short	1 long
BROTHER	99	99 <i>sister</i>	1 omitted		
BUY	94	94 <i>sell</i> 1 pay	1 spend 1 purchase	1 give	2 omitted
CHEAP	93.5	47 <i>expensive</i> 38 <i>dear</i>	6 <i>costly</i> 5 high $\frac{1}{2}$	2 high-priced 1 valuable	1 omitted
COME	98	98 <i>go</i>	1 return	1 return	
COUNTRY	65	43 <i>city</i> 22 <i>town</i> 4 <i>land</i> 3 <i>sea</i>	2 ocean 2 water 1 lake 1 state	1 alien 1 woods 1 air 1 island	1 nation 1 fatherland 16 omitted
DAY	99	99 <i>night</i>	1 week		
DEAD	99	99 <i>alive</i>	1 <i>living</i>		
DIRTY	100	100 <i>clean</i>			
EAST	100	100 <i>west</i>			
EASY	97	80 <i>hard</i> 17 <i>difficult</i>	1 uncomfortable	1 quiet	1 omitted
EMPTY	98	98 <i>full</i>	1 content	1 omitted	
FALSE	84	84 <i>true</i> 4 right 2 truthful	2 untrue 1 good 1 wrong	1 treacherous 1 honest 1 real	3 omitted
FIRST	79	79 <i>last</i>	17 second	1 omitted	
FORGET	94	94 <i>remember</i> 2 think	1 remind 1 omitted	1 know	1 memory
FRIEND	99	89 <i>enemy</i>	10 <i>foe</i>	1 unfriendly	
GLAD	83	40 <i>sad</i> 21 <i>unhappy</i> 19 <i>sorry</i>	3 <i>sorrowful</i> 12 happy 2 mad	1 melancholy 1 miserable 1 omitted	
GOOD	98	98 <i>bad</i>	1 worse	1 poor	
HAPPY	57.5	29 <i>unhappy</i> 43 sad $\frac{1}{2}$ 6 sorrowful $\frac{1}{2}$ 4 miserable $\frac{1}{2}$	1 unfortunate $\frac{1}{2}$ 1 disconsolate $\frac{1}{2}$ 8 sorry 1 happy	1 discontented 1 dull 1 morbid 1 gloomy	1 good 1 mad 1 omitted
HEAVY	98	98 <i>light</i>	1 thin	1 unheavy	
HERE	94.5	93 <i>there</i> 1 <i>elsewhere</i>	1 absent $\frac{1}{2}$ 4 away	1 nowhere	
HIGH	98	98 <i>low</i>	1 short	1 high	
HOT	92	92 <i>cold</i>	4 cool	3 warm	1 omitted
IN	92.5	91 <i>out</i> 3 outside $\frac{1}{2}$	2 on 2 up	1 against 1 omitted	
LAND	90	49 <i>water</i> 41 <i>sea</i>	5 country 2 air	1 county	2 omitted
LATE	93	93 <i>early</i> 3 on time	1 prompt 1 soon	1 present	1 timely
LEFT	91.5	91 <i>right</i> 1 came $\frac{1}{2}$	1 first 1 here	1 remaining 5 omitted	

LESS	88	88 <i>more</i> 5 <i>much</i>	2 <i>many</i> 1 <i>greater</i>	1 <i>plus</i> 1 <i>least</i>	2 <i>omitted</i>
LIGHT	98	97 <i>dark</i>	1 <i>heavy</i>	1 <i>gray</i>	1 <i>white</i>
LIKE	86	59 <i>unlike</i> 13 <i>different</i>	8 <i>dissimilar</i> 6 <i>dislike</i>	6 <i>hate</i> 2 <i>opposite</i>	1 <i>love</i> 5 <i>omitted</i>
LOUD	80.5	30 <i>soft</i> 27 <i>quiet</i> 18 <i>low</i>	2 <i>faint</i> 1 <i>subdued</i> 4 <i>weak</i> $\frac{1}{2}$ 1 <i>gentle</i> $\frac{1}{2}$	5 <i>silent</i> 3 <i>still</i> 1 <i>not loud</i>	1 <i>dim</i> 7 <i>omitted</i>
LOVE	95	95 <i>hate</i>	1 <i>hatred</i>	3 <i>dislike</i>	1 <i>omitted</i>
MANY	93	93 <i>few</i> 4 <i>none</i>	1 <i>one</i>	1 <i>little</i>	1 <i>omitted</i>
MORNING	63	63 <i>evening</i>	36 <i>night</i>	1 <i>noon</i>	
MUCH	66	66 <i>little</i> 24 <i>few</i>	4 <i>less</i> 4 <i>none</i>	1 <i>lots</i> 1 <i>omitted</i>	
NEAR	93	93 <i>far</i>	4 <i>close</i> 2 <i>distant</i>	1 <i>rear</i>	
NEW	99	99 <i>old</i>	1 <i>many</i>		
NOISY	82	82 <i>quiet</i> 3 <i>silent</i> 3 <i>calm</i>	3 <i>still</i> 6 <i>peaceful</i> 2 <i>soft</i>	2 <i>silence</i> 1 <i>noiseless</i> 1 <i>quietly</i>	1 <i>timid</i>
NORTH	99	99 <i>south</i>	1 <i>west</i>		
NOWHERE	87	62 <i>somewhere</i> 13 <i>anywhere</i>	12 <i>everywhere</i> 10 <i>here</i>	2 <i>someplace</i> 1 <i>onwhere</i>	
OPEN	99	57 <i>shut</i>	40 <i>closed</i>	2 <i>close</i>	1 <i>wide</i>
OVER	76.5	74 <i>under</i> 5 <i>below</i> $\frac{1}{2}$ 3 <i>here</i>	2 <i>back</i> 2 <i>across</i> 2 <i>before</i>	2 <i>above</i> 1 <i>beyond</i> 1 <i>near</i>	1 <i>down</i> 7 <i>omitted</i>
OUTSIDE	94.5	91 <i>inside</i> 3 <i>in</i> $\frac{1}{2}$	3 <i>within</i> $\frac{1}{2}$ 2 <i>outside</i>	1 <i>inner</i> $\frac{1}{2}$	
PUSH	77.5	76 <i>pull</i> 3 <i>draw</i> $\frac{1}{2}$ 3 <i>hold</i>	1 <i>back</i> 1 <i>shove</i> 1 <i>open</i>	1 <i>recede</i> 1 <i>detain</i> 1 <i>stop</i>	1 <i>back</i> 1 <i>retard</i> 11 <i>omitted</i>
QUICK	95	95 <i>slow</i>	3 <i>fast</i>	1 <i>rapidly</i>	1 <i>rapid</i>
RAISE	83	83 <i>lower</i> 5 <i>drop</i>	3 <i>fall</i> 1 <i>lowered</i>	1 <i>lift</i> 7 <i>omitted</i>	
RICH	98	98 <i>poor</i>	1 <i>wealthy</i>	1 <i>omitted</i>	
ROUGH	93	88 <i>smooth</i> 4 <i>gentle</i>	1 <i>level</i> 1 <i>uneven</i> 1 <i>fine</i>	1 <i>soft</i> 1 <i>even</i>	1 <i>easy</i> 2 <i>omitted</i>
SHARP	98	85 <i>dull</i>	13 <i>blunt</i>	1 <i>keen</i>	1 <i>quick</i>
SICK	85	85 <i>well</i>	12 <i>healthy</i>	2 <i>ill</i>	1 <i>unhealthy</i>
SOFT	97	97 <i>hard</i>	2 <i>rough</i>	1 <i>rigid</i>	
SOMETHING	95	95 <i>nothing</i>	3 <i>anything</i>	1 <i>some one</i>	1 <i>everything</i>
SON	51	10 <i>father</i> 82 <i>daughter</i> $\frac{1}{2}$	6 <i>sister</i>	1 <i>boy</i>	1 <i>omitted</i>
SOUR	98	98 <i>sweet</i>	1 <i>bitter</i>	1 <i>salt</i>	
STALE	83	83 <i>fresh</i> 3 <i>new</i> 3 <i>good</i>	2 <i>pure</i> 2 <i>old</i>	1 <i>sour</i> 1 <i>stolid</i>	1 <i>better</i> 4 <i>omitted</i>
STAY	89	80 <i>go</i> 8 <i>leave</i> 1 <i>depart</i>	1 <i>hurry</i> 1 <i>outside</i> 1 <i>wait</i>	1 <i>remain</i> 1 <i>come</i> 1 <i>away</i>	4 <i>omitted</i>

STRAIGHT	95	94 <i>crooked</i>	1 <i>bent</i>	5 narrow	
TALL	90.5	88 <i>short</i>	3 small	1 little	3 omitted
THIN	89	45 <i>thick</i>	2 stout	1 thin	3 omitted
		48 fat $\frac{1}{2}$	2 fleshy	1 heavy	
UP	95	95 <i>down</i>	1 below	1 low	
		1 deep	1 high	1 in	
WAR	100	100 <i>peace</i>			
WEAK	96	96 <i>strong</i>	1 slow	1 healthy	1 poor
		1 old			
WET	100	100 <i>dry</i>			
WHITE	98	98 <i>black</i>	1 dim	1 omitted	
WIDER	75	61 <i>narrower</i>	1 shorter	1 close	3 omitted
		28 narrow $\frac{1}{2}$	1 smaller	1 thin	
		2 longer	1 thinner	1 near	
WILD	99	95 <i>tame</i>	1 civilized	1 mild	
		2 <i>domestic</i>	1 <i>gentle</i>		
WINTER	100	100 <i>summer</i>			
WRONG	96	95 <i>right</i>	1 <i>correct</i>	2 good	2 bad
YES	100	100 <i>no</i>			
YOUNG	100	100 <i>old</i>			

Hard Stimulus Words

As in the easy list, the *italicized* words are regarded as meriting full credit. The words followed by 2 are considered worth 2-3 credit, those followed by 1 as worth 1-3 credit, and all other words are given no credit. As in the preceding list, the numbers at the left of the response words indicate the frequency of the various responses. The numbers immediately following the stimulus words indicate the percentage of accuracy in the responses. These numbers, therefore, measure the relative difficulty of the various stimulus words and serve as a basis on which lists of fairly uniform difficulty may be made up or by which a graded list from the easiest to the hardest may be constructed.

ACTIVE	75	26 <i>passive</i>	1 phlegmatic 2	1 sedative 1
		17 <i>inactive</i>	1 slothful 2	1 unactive
		14 slow 2	1 motionless 2	1 stationary
		14 lazy 2	1 still 2	1 quietness
		6 quiet 2	2 indolent 1	1 restless
		3 sluggish 2	2 idle 1	1 dead 1
		3 inert 2	1 resting 1	1 omitted
		1 still 2	1 languid	
AFTER	99	99 <i>before</i>	1 later	
ANIMATED	47	18 <i>lifeless</i>	2 inanimate 1	1 easy-going
		1 <i>spiritless</i>	2 still 1	1 depressed
		19 quiet 2	1 inactive 1	1 sober
		3 dead 2	2 unexcited	1 wild
		2 phlegmatic 2	2 sleepy	1 lowered
		3 unanimated 2	1 spiritual	1 without-spirit
		2 sluggish 2	1 hard-hearted	1 disheartened
		7 slow 1	1 at rest	1 gloomy
		6 dull 1	1 heated	9 omitted
		4 calm 1	1 peaceful	
		3 stupid 1	1 latent	

APART	80	61 <i>together</i>	1 combined 1	1 present
		4 <i>with</i>	1 close 1	1 separate
		1 <i>joined</i>	1 here	1 composed-of
		17 <i>near</i> 2	1 together-with	1 loose
		1 <i>adjacent</i> 2	1 whole	3 omitted
BEAUTIFUL	95	3 <i>within</i> 1	1 separated	
		71 <i>ugly</i>	2 crude	1 horrible
		24 <i>homely</i>	1 sad	1 sordid
BELIEF	78	28 <i>disbelief</i>	1 faithless 1	1 untrue
		24 <i>unbelief</i>	1 suspicious 1	1 faith
		19 <i>doubt</i>	2 ignorance	1 untruth
		4 <i>distrust</i>	1 disregard	1 forgetfulness
		1 <i>infidelity</i>	1 unfaith	1 knowledge
		1 <i>skepticism</i>	1 false	8 omitted
		1 <i>mistrust</i> 2	2 non-belief	
TO BLESS	87	75 <i>to curse</i>	2 to censure	2 to hate
		9 <i>to condemn</i>	1 to blame	1 to scold
		2 <i>to damn</i>	1 to despise	5 omitted
		1 <i>to execrate</i>	1 to desecrate	
BROKEN	75	46 <i>whole</i>	1 repaired 2	3 altogether
		6 <i>smooth</i>	2 fixed 1	1 keep
		8 <i>mended</i>	2 solid 1	1 firm
		4 <i>unbroken</i>	1 regular 1	1 compact
		4 <i>connected</i>	1 flat (land) 1	1 healed
		1 <i>continuous</i>	1 sound 1	1 even
		1 <i>intact</i>	1 entire 1	4 omitted
		1 <i>continued</i> 2	1 mend 1	
		1 <i>level</i> 2	6 straight	
BUSY	72	50 <i>idle</i>	1 free 1	1 quiet
		24 <i>lazy</i> 2	1 motionless 1	1 stupid
		3 <i>indolent</i> 2	1 inactive 1	1 having-time
		3 <i>unemployed</i> 2	1 at-leisure 1	1 slothful
		1 <i>unoccupied</i> 2	2 dull	1 plenty-of-time
		1 <i>at-rest</i> 1	1 timely	6 omitted
CLUMSY	57	39 <i>graceful</i>	2 well-trained 1	1 lively
		8 <i>agile</i> 2	1 smooth 1	1 thin
		1 <i>nimble</i> 2	2 polite 1	1 small
		1 <i>lithe</i> 2	1 swift 1	1 handy
		6 <i>skillful</i> 2	3 careful	1 alert
		2 <i>dexterous</i> 2	2 awkward	1 slight
		5 <i>light</i> 1	2 easy	9 omitted
		3 <i>sleever</i> 1	1 active	
		2 <i>polished</i> 1	1 fine	
		2 <i>refined</i> 1	1 alive	
CONSERVATIVE	60	24 <i>radical</i>	1 exorbitant	1 ready
		20 <i>progressive</i>	1 changeable	1 wasteful
		13 <i>liberal</i>	1 tactless	1 open-hearted
		1 <i>wreckless</i> 2	1 lenient	1 "stand-pat"
		1 <i>hasty</i> 2	1 open-handed	1 plastic
		2 <i>free</i> 1	1 cosmopolitan	1 optimistic
		1 <i>democratic</i> 1	1 talkative	1 rational
		1 <i>open-minded</i> 1	1 common	1 lax
		1 <i>forward</i> 1	1 backward	1 slack
		1 <i>extravagant</i> 1	1 free-handed	10 omitted
		2 <i>spendthrift</i>	1 gentle	
		2 <i>loose</i>	1 unconservative	

CRUEL	75	55 <i>kind</i>	5 good 1	1 loving
		1 <i>humane</i>	3 kind-hearted 1	1 attentive
		12 tender 2	1 considerate 1	1 nice
		7 gentle 2	3 generous	1 benign
		2 kindly 2	1 hard	1 friendly
		1 merciful 2	1 decent	1 unkind
		1 sympathetic 2	1 thoughtful	
DECEITFUL	56	7 <i>frank</i>	1 honorable 1	1 open-faced
		6 <i>straightforward</i>	1 trustworthy 1	1 upright
		4 <i>sincere</i>	1 open 1	1 confidential
		1 <i>ingenuous</i>	1 undeceptive	1 innocent
		39 truthful 2	1 trustful	1 open-minded
		15 honest 2	1 loyal	1 honesty
		7 true 1	1 conscientious	5 omitted
TO DEGRADE	76	2 faithful 1	1 thankful	
		35 <i>to elevate</i>	2 to improve 1	1 to uphold
		30 <i>to uplift</i>	2 to upraise 1	1 to ascend
		4 <i>to exalt</i>	2 to-raise-up 1	1 to heighten
		9 to raise 1	1 to honor 1	1 to edify
		3 to lift up 1	1 to better 1	1 to lower
		2 to build up 1	1 to generate	3 omitted
DESPONDENT	86	39 <i>happy</i>	3 exulted 2	1 encouraged 1
		17 <i>hopeful</i>	1 joyous 2	1 glad 1
		19 <i>cheerful</i>	1 light-hearted 2	1 alert
		1 <i>courageous</i>	2 optimistic 1	1 confident
		4 gay 2	1 courage 1	5 omitted
		3 joyful 2	1 hilarious 1	
DILIGENT	77	55 <i>lazy</i>	1 loafing 1	1 unindustrious
		9 <i>slothful</i>	1 slow 1	1 good
		7 idle 2	1 shirk 1	1 ignorant
		5 careless 2	1 lackadaisical 1	1 industrious
		2 negligent 2	1 dull	1 drollful
		1 neglectful 2	1 studious	1 non-diligent
		2 lax 1	1 sluggardly	3 omitted
DISASTROUS	45	2 unstudious 1	1 unfaithful 1	
		4 <i>fortunate</i>	1 elevating	1 fortuitous
		2 <i>lucky</i>	1 fine	1 not dangerous
		1 <i>auspicious</i>	1 non-disastrous	1 not harmful
		26 helpful 2	1 calm	1 success
		18 beneficial 2	1 efficient	1 glorious
		9 safe 2	1 infurious	1 harmless
		3 successful 1	1 crowning	11 omitted
		2 victorious 1	1 genial	
		1 advantageous 1	1 all right	
		1 favorable 2	1 insignificant	
		2 good	1 not-disastrous	
		2 common	1 great	
EXCITING	60	20 <i>quiet</i>	11 calm 2	1 unexcitable
		6 <i>quieting</i>	1 depressing 2	1 exhilarating
		2 <i>soothing</i>	1 tedious 2	1 despairing
		6 calming 2	1 mollifying 2	1 peaceful
		5 uninteresting 2	4 slow 1	1 encouraging
		2 monotonous 2	4 tame 1	1 dead
		2 uneventful 2	3 stupid 1	1 wholesome
		1 pacifying 2	4 unexciting	1 smooth
		12 dull 2	2 still	5 omitted

TO FLOAT	82	82 <i>to sink</i>	1 stationary	1 to-stammer
		2 to drown	1 to-stay	1 to-be-stationary
		2 to swim	1 to-stay-still	1 tied-down
		1 to-be-forced	1 to-crawl	1 to-stand
FORCIBLE	20	1 to run	1 to-fly	3 omitted
		1 <i>ineffective</i>	1 to lead	1 hinder
		1 <i>powerless</i>	1 immovable	1 retard
		24 weak 2	1 voluntary	1 non-forcible
		1 gentle 2	1 lacking-force	1 easily
		2 weakly 1	1 allow	1 uneasily
		1 trivial 1	1 unforceful	1 optional
		4 unforcible	1 free	1 persuaded
		3 quiet	1 unsteady	1 yielding
		3 easy	1 faint	1 not-forcible
		2 lenient	1 voluntarily	1 unrestrictive
		2 persuasive	1 lax	1 unconventional
		2 poor	1 backward	1 indifferent
		2 slow	1 without-strength	1 light
		1 loose	1 unpowerful	24 omitted
FREQUENTLY	66	54 <i>seldom</i>	1 scarcely 1	1 never
		4 <i>rarely</i>	3 not often	1 unoccasionally
		2 <i>infrequently</i>	2 unfrequent	1 unoften
		2 occasionally 2	2 slow	1 a-few-times
		1 unusually 2	2 often	1 not-so-often
		1 almost-never 2	1 seldomly	1 less often
		6 infrequent 1	1 less	7 omitted
		4 few 1	1 always	
GENEROUS	87	74 <i>stingy</i>	2 cruel 1	1 extravagant
		8 <i>selfish</i>	1 greedy 1	1 kind
		4 miserly 2	1 miser 1	1 humble
		4 "tight" 1	1 wealthy	2 omitted
GENUINE	50	2 <i>spurious</i>	1 adulterated 1	1 poor
		2 <i>counterfeit</i>	1 imitative 1	1 penurious
		57 false 2	1 debased 1	1 shabby
		1 artificial 2	1 diluted 1	1 not true
		5 fake 2	3 untrue	1 cheap
		3 unreal 1	2 ungenune	9 omitted
		3 imitation 1	1 superficial	
		2 deceitful 1	1 insincere	
GRAND	50	4 <i>mean</i>		
		6 <i>simple</i>	6 ugly 1	1 bad
		4 <i>humble</i>	4 homely 1	1 dull
		4 <i>lowly</i>	4 ignoble 1	1 peculiar
		12 small 2	2 ordinary 1	1 shallow
		10 poor 2	2 trivial 1	1 cheap
		5 low 2	1 modest 1	1 endowed
		5 common 2	2 horrid	1 beautiful
		3 insignificant 2	2 happy	1 disagreeable
		2 plain 2	1 not-wonderful	10 omitted
HAUGHTY	43	2 little 2	1 tedious	
		34 <i>humble</i>	3 proud	1 bad
		5 meek 2	2 pleasant	1 quiet
		3 lowly 2	2 loving	1 innocent
		5 kind 1	2 modest	1 sensible
		3 gentle 1	1 undignified	1 dignified
		1 humility 1	1 pride	1 subservient
		1 low 1	1 kindly	1 charitable
		1 courteous 1	1 peaceful	1 pleasing
		3 common	1 thoughtful	1 mild
		3 democratic	1 simple	17 omitted

HINDRANCE	76	63 <i>help</i>	1 helping 1	1 urge
		8 <i>aid</i>	1 path	1 nothing
		2 <i>assistance</i>	1 obstacle	1 allowance
		1 <i>benefit</i>	1 non-hindrane	1 promoter
		2 helpful 1	1 means	1 helpmate
		1 accelerator 1	1 easy	10 omitted
TO HOLD	90	1 helper 1	1 improvement	
		29 <i>to let go</i>	1 to separate	
		24 <i>to drop</i>	1 to depart	1 to let fall
		20 <i>to loose</i>	1 to give	1 to relax
		6 <i>to release</i>	1 to throw down 1	1 quit
		5 <i>to let loose</i>	1 to throw away 1	1 to lose
IGNORANT	58+	5 <i>to loosen</i>	1 to give up	
		14 <i>learned</i>	13 intelligent 2	2 brilliant 1
		2 <i>knowing</i>	9 educated 1	1 right
		1 <i>informed</i>	5 bright 1	2 omitted
		47 wise 2	3 smart 1	
		1 well-informed 2		
IMAGINARY	49	40 <i>real</i>	3 fact	1 plastic
		2 <i>realistic</i>	2 exact	1 quiet
		6 true 1	2 matter-of-fact	1 present
		4 truthful 1	2 thoughtful	1 unresponsive
		3 unimaginative 1	1 conservative	1 imaginative
		2 actual 1	1 absent-minded	1 rational
		2 unimaginative 1	1 sure	1 literal
		1 reality 1	1 concrete	1 thoughtless
		2 unpractical 1	1 prosaic	13 omitted
		3 dull		
IMPOVERISH	51	43 <i>enrich</i>	1 wealthy	
		3 replenish 2	3 increase	1 embellish
		10 rich 1	3 wealth	1 supply
		3 help 1	2 improve	1 overfed
		2 strengthen 1	1 profit	1 heal
		2 nourish 1	1 plentiful	1 fill
		1 make rich 1	1 good	1 to give
		1 assist 1	1 to promote	16 omitted
		84 <i>decrease</i>	1 lower	1 discuss
		6 <i>diminish</i>	1 lose	1 remove
INCREASE	94	4 <i>lessen</i>	1 destroy	1 omitted
		42 <i>helpful</i>	1 beneficent 2	1 non-injurious
		12 <i>beneficial</i>	4 healthy 1	1 not-harmful
		13 healthful 2	3 wholesome 1	1 sane
		7 safe 2	1 unharmed 1	6 omitted
		7 harmless 2	1 uninjurious 1	
INNOCENT	75	57 <i>guilty</i>	1 vile 2	1 guileful
		12 wise 2	3 guilt 1	1 fickle
		4 knowing 2	3 sophisticated 1	1 bold
		2 sinful 2	1 guiltiness 1	1 viceful
		2 criminal 2	1 intelligent 1	1 deceit
		2 wicked 2	1 vicious 1	6 omitted
INSIGNIFICANT	78	31 <i>important</i>	1 noted 1	1 splendid
		29 <i>significant</i>	1 noticeable 1	1 large
		9 <i>prominent</i>	2 useful	1 mighty
		6 great 2	1 big	1 proud
		3 grand 2	1 magnanimous	1 gorgeous
		1 distinguished 2	1 very-great	1 permanent
		4 worthy 1	1 broad	3 omitted

TO LACK	85	70 <i>to have</i> 9 <i>to possess</i> 1 <i>to be supplied</i> 2 <i>to abound</i> 2	7 <i>to gain</i> 1 3 <i>to have-plenty</i> 1 1 <i>to acquire</i> 1 1 <i>to control</i>	1 <i>to lavish</i> 1 <i>to need</i> 1 <i>plenty</i> 3 <i>omitted</i>
LEVEL	62	41 <i>rough</i> 11 <i>hilly</i> 1 <i>undulating</i> 1 <i>mountainous</i> 8 <i>uneven</i> 2 4 <i>broken</i> 2 1 <i>rocky</i> 1 1 <i>upright</i> 1	1 <i>slanting</i> 8 <i>crooked</i> 3 <i>sloping</i> 3 <i>unevel</i> 2 <i>below</i> 1 <i>inoline</i> 1 <i>not level</i> 1 <i>heighten</i>	1 <i>rugged</i> 1 <i>angular</i> 1 <i>unraised</i> 1 <i>stiff</i> 1 <i>unstable</i> 7 <i>omitted</i>
MISER	66	45 <i>spend-thrift</i> 22 <i>philanthropist</i> 2 3 <i>benefactor</i> 2 5 <i>generous</i> 1 3 <i>liberal</i> 1 3 <i>giver</i> 1 1 <i>altruist</i> 1 1 <i>spendthrift</i> 1 1 <i>extravagant</i> 1	2 <i>free-hearted</i> 1 <i>wealthy-man</i> 1 <i>poverish</i> 1 <i>rich</i> 1 <i>millionaire</i> 1 <i>free-spender</i> 1 <i>kind</i> 1 <i>gainer</i> 1 <i>saver</i>	1 <i>thrifty</i> 1 <i>generous-man</i> 1 <i>hospitable</i> 1 <i>helper</i> 2 <i>omitted</i>
MOTION	50	16 <i>rest</i> 1 <i>repose</i> 20 <i>quiet</i> 2 4 <i>inaction</i> 2 4 <i>inactivity</i> 2 2 <i>quietness</i> 2 2 <i>silence</i> 2 1 <i>at-rest</i> 2 1 <i>quietude</i> 2	1 <i>quiescence</i> 2 1 <i>motionless</i> 2 14 <i>still</i> 1 11 <i>stationary</i> 1 2 <i>inactive</i> 1 1 <i>immobile</i> 1 2 <i>stop</i> 1 <i>stiff</i> 1 <i>constant</i>	1 <i>standing</i> 1 <i>lack-of-motion</i> 1 <i>silent</i> 1 <i>steadfastly</i> 1 <i>inertia</i> 1 <i>passive</i> 1 <i>passiveness</i> 1 <i>leisure</i> 7 <i>omitted</i>
OVER	87	80 <i>under</i> 1 <i>underneath</i> 10 <i>below</i> 2	2 <i>here</i> 1 <i>back</i> 3 <i>above</i>	1 <i>in</i> 1 <i>near</i> 1 <i>omitted</i>
PART	86	78 <i>whole</i> 1 <i>unite</i> 1 <i>connect</i> 1 <i>entire</i> 1 2 <i>together</i>	6 <i>all</i> 2 <i>separate</i> 1 <i>share</i> 1 <i>altogether</i> 1 <i>keep</i>	1 <i>stay</i> 1 <i>knit</i> 1 <i>keep together</i> 3 <i>omitted</i>
PAST	76	31 <i>future</i> 66 <i>present</i> 2	2 <i>coming</i> 2	1 <i>before</i> 1
PERMANENT	54	7 <i>transitory</i> 7 <i>transient</i> 3 <i>ephemeral</i> 3 <i>fleeting</i> 35 <i>temporary</i> 2 4 <i>changing</i> 2 3 <i>changeable</i> 2 1 <i>temporal</i> 2	7 <i>movable</i> 1 6 <i>unstable</i> 1 1 <i>transportable</i> 1 1 <i>flimsy</i> 1 2 <i>passing</i> 1 1 <i>unfixed</i> 1 <i>effervescent</i> 2 <i>unsteady</i>	2 <i>not-stationary</i> 2 <i>unpermanent</i> 1 <i>monetary</i> 1 <i>stationary</i> 1 <i>short</i> 8 <i>omitted</i> 1 <i>loose</i>
PERMIT	69	33 <i>refuse</i> 20 <i>forbid</i> 4 <i>hinder</i> 4 <i>prohibit</i> 8 <i>deny</i> 2 4 <i>disallow</i> 1 3 <i>prevent</i> 1	1 <i>restrain</i> 1 1 <i>restrict</i> 1 1 <i>inhibit</i> 1 4 <i>not allow</i> 1 <i>allow</i> 1 <i>reject</i> 1 <i>exclude</i> 1	1 <i>give</i> 1 <i>restraint</i> 1 <i>hold</i> 1 <i>non-permit</i> 1 <i>keep</i> 9 <i>omitted</i>

PRECISE	31	13 <i>inexact</i>	2 exact	1 uncorrect
		6 <i>inaccurate</i>	2 slovenly	1 confused
		13 careless 1	2 uncertain 1	1 non-exact
		8 incorrect 1	2 irregular	1 non-precise
		8 indefinite 1	1 uncouth	1 unexacting
		3 loose 1	1 loud	1 unprecise
		1 approximate 1	1 wrong	1 vague
		1 lax 1	1 awkward	19 omitted
		5 unexact	1 inadequate	
		2 rude	1 tardy	
PRESERVE	67	36 <i>destroy</i>	3 decay 1	4 spend
		17 <i>spoil</i>	2 let-go 1	2 keep
		1 <i>ruin</i>	1 rotten 1	1 to-lessen
		7 waste 2	1 abandon 1	1 shatter
		1 squander 2	1 perish 1	1 abolish
		10 lose 1	1 relinquish	1 degenerate
		4 throw-away 1	1 give 1	3 omitted
PRIDE	21	16 <i>humility</i>	5 careless	1 rude
		5 humble 1	1 dignity	1 carelessness
		1 humiliation 2	1 non-egotistical	1 democratic
		1 lowliness 2	1 deceit	1 simple
		1 humbleness 2	1 slovenliness	1 slothfulness
		1 <i>self-abasement</i>	1 disrespect	1 slouchy
		1 modesty 1	1 shame	1 undignified
		6 prejudice	1 sloth	43 omitted
		2 democracy	1 untidy	
		2 insolence	1 dishonest	
PROFICIENT	51	26 <i>inefficient</i>	3 poor 1	1 unable 1
		2 <i>incompetent</i>	4 careless	1 efficient
		1 <i>ineffective</i>	3 unefficient	1 helpless
		9 deficient 2	3 unproficient	1 unreliable
		6 incapable 2	2 dull	1 unsufficient
		5 unskilled 2	2 non-proficient	1 unuseful
		5 unskillful 2	1 unproficient	1 awkward
		3 lacking 2	1 wasteful	1 ignorant
		2 unprepared 2	1 without-power	6 omitted
		2 weak 1	1 inaccurate	
		1 inefficiently 1	1 lax	
REFINED	85	21 <i>coarse</i>	3 boorish 1	1 ignorant
		15 <i>rude</i>	1 untidy 1	1 impolite
		15 <i>uncultured</i>	1 untutored 1	1 lady-like
		8 <i>crude</i>	1 rugged 1	1 not-educated
		13 <i>unrefined</i>	1 adulterated 1	1 common
		10 uncouth 2	1 slouchy 1	1 omitted
		1 uncultivated 2	1 wild 1	
		7 rough 1	5 vulgar	
REMEMBER	100	100 <i>forget</i>		
TO RESPECT	69	41 <i>to disrespect</i>	3 to distrust 1	1 to unhonor
		11 <i>to despise</i>	2 to ignore 1	1 "to hold in contempt"
		5 <i>to dishonor</i>	1 to debase 1	
		3 <i>to disregard</i>	1 to insult 1	1 lack of reverence
		2 <i>to disdain</i>	1 to disparage 1	1 to disinherit
		1 to scorn 2	1 to not-respect	1 to look down upon
		1 to abhor 2	1 to lower	1 to be rough
		5 to hate 1	1 to honor	1 "to show contempt"
		4 to dislike 1	1 "to have contempt for"	7 omitted
			1 to degrade	

RESULT	50	30 beginning 2	1 unless	1 mistake
		28 <i>cause</i>	1 future	1 experiment
		2 question 1	1 occasion	1 to fail
		2 problem 1	1 nothing	1 conclusions
		1 proposition 1	1 data	1 Q. E. D.
		2 failure	1 effect	1 fact
		1 without	1 answer	19 omitted
		1 prediction	1 not-successful	
TO REVEAL	75	46 <i>to conceal</i>	2 to cover up 1	1 to portray
		22 <i>to hide</i>	1 to keep hidden 1	1 to close
		1 <i>to secrete</i>	1 to withhold 1	1 to not tell
		1 to obscure 2	5 to disclose	1 to retain
		5 to cover up 1	2 to tell	1 to preserve
		3 to keep 1	1 to show	1 to shut out
		3 to keep secret 1	1 to silence	
RIGID	53	14 <i>lax</i>	2 pliable 2	1 undulating
		11 loose 2	1 pliant 2	1 unstable
		10 easy 2	9 soft 1	1 free
		9 flexible 2	2 plastic 1	1 movable
		4 limp 2	1 slack 1	1 tense
		4 relaxed 2	1 yielding 1	1 subtle
		3 flabby 2	1 flimsy 1	1 unstable
		3 lenient 2	1 unfirm 1	1 moving
		2 elastic 2	2 careless	1 weak
		2 limber 2	2 smooth	7 omitted
ROUGH	94	92 <i>smooth</i>	1 flat	1 soft
		1 <i>polished</i>	1 refined	1 peaceful
		1 <i>plane</i>	1 even	1 straight
RUDE	67	39 <i>polite</i>	1 urbane 2	1 kind
		7 <i>courteous</i>	1 well-bred 2	1 intellectual
		3 <i>refined</i>	9 polished 1	1 considerate
		1 <i>genteel</i>	1 educated 1	1 modest
		14 cultured 2	4 sympathy	1 good
		4 gentle 2	2 prudent	1 fine
		1 cultivated 2	2 simple	5 omitted
SELL	99	98 <i>buy</i>	1 purchase	1 take
SERIOUS	40	19 <i>frivolous</i>	1 laughter 1	1 full-of-life
		7 gay 2	1 glad 1	1 thoughtless
		2 hilarious 2	1 frolicksome 1	1 polite
		1 jesting 2	1 lightly 1	1 unserious
		8 happy	1 "fooling" 1	1 false
		7 light 1	1 blithesome 1	1 simple
		4 fickle 1	2 careless	1 smiley
		4 light-hearted 1	2 flighty	1 slight
		3 cheerful 1	1 happy-going	1 unwell
		3 joyful 1	1 playful	8 omitted
		2 foolish 1	1 common	
		2 joyous 1	1 free	
		2 flippant	1 care-free	
		1 flight-minded 1	1 happy-go-lucky	
		1 silly 1	1 doubtful	
SILLY	81	27 <i>wise</i>	3 intelligent 1	1 refined
		17 <i>serious</i>	1 foolish	1 sad
		31 <i>sensible</i>	1 decent	1 witty
		3 sober 2	1 thoughtful	1 wisely
		2 sane 2	1 reserved	1 educated
		2 dignified 2	2 sincere	1 unfoolish
		1 prudent 2	1 common-sense	1 omitted

SLEEPY	70	14 <i>wakeful</i>	3 fresh 2	1 rested
		70 <i>awake</i> 2	1 spry 1	
		10 <i>wide-awake</i> 2	1 lively 1	
SIMPLE	86	62 <i>complex</i>	5 hard 2	1 compound 1
		7 <i>complicated</i>	1 fastidious 1	1 crafty 1
		4 <i>elaborate</i>	1 easy	1 delicate
		1 <i>intricate</i>	1 intelligent 1	3 omitted
		11 <i>difficult</i> 2	1 cultivated 1	
SINFUL	54	3 <i>sinless</i>	9 truthful 1	3 honest
		3 <i>holy</i>	3 upright 1	2 true
		1 <i>Godly</i>	3 pious 1	1 "goody"
		28 <i>good</i> 2	2 religious 1	1 just
		13 <i>righteous</i> 2	1 noble 1	1 peaceful
		11 <i>pure</i> 2	1 perfect 1	1 right
		4 <i>innocent</i> 2	1 conscientious 1	3 omitted
		4 <i>virtuous</i> 2	1 saint 1	
TO SPEND	85	79 <i>to save</i>	12 to keep 1	3 to buy
		1 to earn 2	1 to collect 1	1 to take
		1 to get 2	1 to receive 1	1 to give
STINGY	82	48 <i>generous</i>	1 free-handed 2	1 beneficent
		15 <i>liberal</i>	1 open-handed 2	1 good-fellow
		2 <i>lavish</i>	3 benevolent 1	1 hospitable
		1 <i>free-hearted</i>	1 philanthropic 1	1 friendly
		9 <i>extravagant</i> 2	2 charitable 1	1 lenient
		2 <i>free</i> 2		
		7 <i>spendthrift</i> 2	1 spendthrift 1	7 omitted
STORMY	64	25 <i>calm</i>	2 pleasant 1	
		28 <i>clear</i> 2	2 smooth 1	1 mild
		10 <i>peaceful</i> 2	1 clement 1	
		9 <i>quiet</i> 2		
		6 <i>fair</i> 2	2 sunshine	1 sunshiny
		2 <i>still</i> 2	1 silence	1 bright
		3 <i>fine</i> 1	1 nice	1 clear-weather
			1 windy	1 good-weather
				2 omitted
STRENGTH	92	89 <i>weakness</i>	1 weakly 1	1 without-power
		7 <i>weak</i> 1		2 omitted
STRAIGHT	98	96 <i>crooked</i>	1 bent	2 narrow
		1 <i>curved</i>		
STRICT	62	20 <i>lax</i>	18 easy 1	1 inexact 1
		17 <i>loose</i>	2 slack 1	1 scattered
		21 <i>lenient</i>	1 disciplineless 1	1 unsystematic
		4 <i>liberal</i>	1 laxity 1	1 good
		3 <i>careless</i> 2	1 undisciplined 1	1 pliable
				7 omitted
SUAVE	20	2 <i>impolite</i>	2 blunt 1	1 excited
		1 <i>brusque</i>	1 undiplomatic 1	1 discouraged
		10 <i>rough</i> 2	1 frank 1	1 brisk
		3 <i>rude</i> 2	1 harsh 1	1 suspicious
		3 <i>coarse</i> 2	1 unpolite 1	1 stern
		2 <i>disagreeable</i> 2	2 deceitful	1 straight
		1 <i>ungracious</i> 2	3 hard	1 smooth
		1 <i>boorish</i> 2	1 gentle	1 liberalized
		1 <i>uncouth</i> 2	1 ruffled 1	1 silent
		2 <i>crude</i> 1	1 candid	1 frankness
		2 <i>abrupt</i>	1 truthful	47 omitted

SUCCEED	93	92 <i>fail</i> 2 <i>failure</i> 1 1 <i>lose</i> 1	1 <i>retrace</i> 1 <i>precede</i> 1 <i>not succeed</i> 1 <i>slow</i>	1 <i>unsuccessful</i> 1 <i>omitted</i>
SURE	69	46 <i>uncertain</i> 18 <i>doubtful</i> 4 <i>undecided</i> 1 <i>unconfident</i> 1 1 <i>insecure</i> 1	1 <i>hesitating</i> 1 5 <i>unsafe</i> 1 <i>uneasy</i> 1 <i>false</i> 1 <i>diffident</i> 1 <i>unstable</i>	5 <i>unsure</i> 1 <i>not-sure</i> 1 <i>untrue</i> 1 <i>deceitful</i> 12 <i>omitted</i>
SUSPICIOUS	40	10 <i>unsuspicious</i> 9 <i>trustful</i> 5 <i>trusting</i> 2 <i>unsuspecting</i> 1 <i>confiding</i> 2 6 <i>credulous</i> 2 2 <i>innocent</i> 2 5 <i>confident</i> 1 4 <i>trusty</i> 1 3 <i>confidential</i> 1 2 <i>trustworthy</i> 1	2 <i>believing</i> 1 1 <i>belief</i> 1 1 <i>guileless</i> 1 1 <i>unwary</i> 1 1 <i>confidence</i> 1 1 <i>believe</i> 1 1 <i>gullible</i> 1 1 <i>confide</i> 1 5 <i>frank</i> 4 <i>truthful</i> 1 <i>without-suspicion</i>	1 <i>simple</i> 1 <i>respect</i> 1 <i>open-minded</i> 1 <i>true</i> 1 <i>right</i> 1 <i>open-hearted</i> 1 <i>friendly</i> 1 <i>loyal</i> 1 <i>honest</i> 1 <i>faithful</i> 22 <i>omitted</i>
TO TAKE	85	54 <i>to give</i> 23 <i>to leave</i> 3 <i>to let go</i> 2 2 <i>to loose</i> 2 2 <i>to refuse</i> 2 2 <i>to give away</i> 2	1 <i>to release</i> 2 1 <i>to give up</i> 2 1 <i>to bring</i> 1 1 <i>to give back</i> 1 2 <i>to keep</i> 1 <i>to put</i>	1 <i>to lose</i> 1 <i>to let</i> 4 <i>to receive</i> 1 <i>to let alone</i>
TARDY	64	10 <i>punctual</i> 9 <i>prompt</i> 35 <i>early</i> 2 27 <i>on time</i> 2 1 <i>before-time</i> 2	7 <i>present</i> 1 2 <i>ahead-of-time</i> 1 1 <i>on hand</i> 1 3 <i>late</i> 1 <i>ready</i>	1 <i>slow</i> 1 <i>fast</i> 1 <i>precise</i> 1 <i>omitted</i>
TENDER	76	30 <i>tough</i> 15 <i>harsh</i> 22 <i>hard</i> 2 17 <i>rough</i> 2 4 <i>cruel</i> 2	2 <i>hard-hearted</i> 2 2 <i>coarse</i> 1 1 <i>unkind</i> 1 1 <i>severe</i> 1 <i>separate</i>	1 <i>cool</i> 1 <i>gentle</i> 1 <i>forcible</i> 1 <i>omitted</i>
UNLESS	22	21 <i>if</i> 1 <i>even if</i> 2 5 <i>except</i> 3 <i>however</i> 3 <i>without</i> 3 <i>with</i> 3 <i>certainly</i> 2 <i>perhaps</i> 1 <i>than</i> 1 <i>away</i>	1 <i>but</i> 1 <i>therefore</i> 1 <i>anyway</i> 1 <i>since</i> 1 <i>less</i> 1 <i>otherwise</i> 1 <i>really</i> 1 <i>sure</i> 1 <i>nevertheless</i> 1 <i>will</i>	1 <i>though</i> 1 <i>yet</i> 1 <i>yet if</i> 1 <i>because</i> 1 <i>provided</i> 1 <i>if so</i> 1 <i>always</i> 1 <i>although</i> 1 <i>to</i> 38 <i>omitted</i>
VENTURESOME	44	11 <i>careful</i> 4 <i>cautious</i> 13 <i>cowardly</i> 2 9 <i>timid</i> 2 7 <i>afraid</i> 2 6 <i>fearful</i> 2 13 <i>conservative</i> 1 1 <i>hesitant</i> 1 1 <i>shy</i> 1 1 <i>fearsome</i> 1	1 <i>reserved</i> 1 1 <i>retired</i> 1 2 <i>sure</i> 2 <i>quiet</i> 1 <i>backward</i> 1 <i>non-venturesome</i> 1 <i>non-daring</i> 1 <i>slow</i> 1 <i>brave</i> 1 <i>uncertain</i>	1 <i>non-risky</i> 1 <i>imaginative</i> 1 <i>non-daring</i> 1 <i>dull</i> 1 <i>fearlessness</i> 1 <i>coward</i> 1 <i>heedful</i> 15 <i>omitted</i>

VERTICAL	81	81 <i>horizontal</i>	3 perpendicular	2 longitudinal
		4 slant	2 slanting	2 straight
		3 crooked	2 aslant	1 downward
WEARY	26	26 <i>rested</i>	1 revive 1	2 healthy
		8 <i>refreshed</i>	4 restful	2 lively
		21 fresh 2	3 happy	1 cheery
		3 refresh 2	3 tired	1 ambitious
		2 rest 2	2 vigorous	1 vivacious
		1 enliven 2	2 strong	1 well
		2 spry 1	2 energetic	6 omitted
		1 rejuvenated 1	1 full-of-life	
		1 untired 1	1 full-of-pep	
		1 tireless 1	1 bright	
		•		
WILD	99	93 <i>tame</i>	2 <i>gentle</i>	1 cultivated 2
		2 <i>domesticated</i>	1 <i>civilized</i>	1 peaceful
TO WIN	97	91 <i>to lose</i>	8 to fail 2	1 to lose out.

A STUDY IN HANDWRITING

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and

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The aim in this study of handwriting is to discover the relative value of:

1. Methods which differ in such mechanical factors as slant, spacing, and formation of letters.

2. Methods which differ in such factors as the manner of holding the pen and the movement of the arm, hand, and fingers.

The qualities of penmanship which are tested are Speed and Legibility. The effect, on each of these three qualities, of Slant, Spacing, Size of Letters, Form of Letters, Manner of Holding the Pen, and Movement is discovered by statistical treatment of samples of handwriting.

SCHEME FOR TABULATING DATA

I. Slant

The slant of the letters is determined by six careful measurements with a celluloid protractor on each sample of writing. The number of words written during one minute and during five minutes are tabulated separately. The classification of the various slants of handwriting is that used by Dr. Leonard P. Ayres, as given in Bulletin No. 113 of the Russell Sage Foundation, viz.:

- | | |
|-------------------|--|
| A. Vertical, | 90° to 80° from horizontal |
| B. Medium Slant, | 80° to 55° " " |
| C. Extreme Slant, | 55° to 30° " " |
| D. Back-hand, | "Any writing in which the characteristic slant of the letters (is) * * to the left of the vertical." |
| E. Mixed Writing, | "A writing composed of two or more styles." |

II. Spacing

By spacing is meant the average horizontal distance between letters as determined by finding the average of five different measurements between consecutive vowels in words and five different measurements between a consonant and a vowel. The measurements are made with a metric scale. The distances measured are from apices of proximate crests of the letters in the case of vowels, and from the apex of the proximate crest of the vowel and the nearest portion of the consonant. The horizontal distance between the letters relates to the line on which the handwriting is superscribed.

A. Close Spacing,

The distance between the letters being from 1 millimeter to 3 millimeters.

(See Ayres' Scale, sample No. 30-B.)

B. Medium Spacing.

3 mm. to 5 mm.

(See Ayres' Scale, sample No. 70-B.)

C. Open Spacing.

5 mm. to 7 mm.

(See Ayres' Scale, sample No. 90-C.)

III. Arrangement

The horizontal spacing of words; i. e., The distance between words in the same line. The measurements are made between the nearest proximate portion of letters, last and first in order, respectively, of the words considered. In this instance there are at least five measurements and the final calculation made is based upon the average of these results.

A. Close Arrangement.

Handwriting in which the average just explained shows a distance between words of zero millimeters to 3 millimeters.

(See Ayres' Scale, sample No. 50-B.)

B. Medium Arrangement.

Handwriting in which the distance between words is 3 mm. to 5 mm.

(See Ayres' Scale, sample No. 70-B.)

C. Open Arrangement.

Handwriting in which the distance between words is 5 mm. to 7 mm.

(See Ayres' Scale, sample No. 90-A.)

IV. Letters

Each sample is classified in the tabulation according to the size of the letters, as determined by actual measurement. The final calculation made is the average result secured by five different measurements of the vertical height of the vowels as written.

A. Small Letters.

The height being from 1 mm. to 2 mm.

(See Ayres' Scale, sample No. 30-B.)

B. Medium Letters.

The height being from 2 mm. to $3\frac{1}{2}$ mm.

(See Ayres' Scale, sample No. 70-B.)

C. Large Letters.

The height being from $3\frac{1}{2}$ mm. to 5 mm.

(See Ayres' Scale, samples Nos. 20-A & 20-C.)

After studying the arrangement of 192 samples of handwriting the following qualifications also were determined upon and used in the averages, viz., Letters are considered large on the average if the consonants, without regard to the size of the vowels, are correspondingly large; i. e., enough larger than the vowels to influence the general appearance of the handwriting so as to cause the examiner to rate the writing as *small*, *medium*, or *large*. The exceptional width of loops also is noted.

a. Small.

When l, h, k, f (p, t, or d) are 1 mm. to 5 mm. above the line. (f, p, 5 mm. below or 5 mm. above.)

b. Medium.

When the letters just mentioned under (a) are 5 mm. to 7 mm. above the line or below as indicated.

c. Large.

When the letters referred to range from 7 mm. to 10 mm.

V. Hand

The handwriting is further studied to determine whether it is:

A. Loose.

With the pen held in an easy manner and the position easily assumed. (The opposite to cramped.)

B. Cramped.

Fingers sharply bent and the general position of the hand and fingers showing tenseness. (The opposite to loose.)

C. Peculiar.

Left handed or writing with the pen in some other position than that of being held between the thumb and the first finger.

VI. Movement

Movement in writing as characterized by being:

A. Finger Movement.

Only the fingers being moved.

B. Arm Movement.

Some movement of the fingers but also considerable movement of the arm.

C. Free-arm Movement.

The respective movements of the fingers and of the arm made while writing, being proportionally equal in amount.

VII. Legibility

As determined in comparison with the Ayres' scale of Hand-writing, grading the samples from 20% to 90%.

VIII. Sex and Age

The sex and age of each writer were recorded at the time the samples of writing were collected from the pupils in the various schools.

IX. Scheme for Determining the Number of Words Written in Each Sample

A. The words are counted.

B. The incomplete words are checked and one-fifth of the value of a complete word is deducted for each letter omitted.

C. Periods, i's dotted, t's crossed are counted one-tenth of a word, i. e., it is as difficult to make ten periods as it is to write one whole word.

D. Where a word is cancelled (crossed-out) by a long (10 mm.) dash two-tenths of a word is added: when the dash is 6 mm. or less in length, one-tenth of a word is added. The number of words written in the samples is given decimally.

X. *Directions for Securing the Samples of Handwriting*

The coöperation of teachers in certain elementary schools of Boston and vicinity was secured. Ruled paper was distributed among the pupils. The children were directed to write their name and age on each sheet of paper used.

- A. The materials used in writing were uniform and were furnished.
- B. The purpose and plan of the tests were explained to the pupils in uniform terms.
- C. When all were ready to write the teacher said, "I want to find out how quickly you can write. I shall give you a sentence to write over and over again for one minute, then for five minutes."

"You are to write as fast as you can without scribbling. Don't start until I tell you, however, you must practise first. Here is the sentence, 'Jolly kings bring gifts while happy maids dance.'"

"Repeat it. Write it once. Now I will try you for a few seconds. Get ready to write when I say 'go,' and stop when I say 'stop.' *Go. . . . Stop.*"

This was repeated and then the regular test was given and the samples of writing were collected.

DATA

A. *Total number of samples of handwriting—604.*

Classification of samples

Vertical Writing.....	52
Medium Slant.....	183
Extreme Slant.....	261
Back-hand.....	15
Mixed Writing.....	93

B. *The average number of words written.*

One Minute		Five Minutes
20.223	Vertical Writing	91.621
21.654	Medium Slant	96.092
22.274	Extreme Slant	101.687
25.546	Back-hand	120.040
22.536	Mixed Writing	101.358

C. *Average legibility as determined by comparison with the Ayres' Scale for Handwriting.*

Classification	Grade (per cent. of 100)
Vertical Writing.....	57.98
Medium Slant.....	48.22
Extreme Slant.....	43.58
Back-hand.....	55.00
Mixed Writing.....	47.84

D. *The median of the number of words written.*

One Minute		Five Minutes.
21.9	Vertical Writing	94.6
21.8	Medium Slant	97.0
22.0	Extreme Slant	101.9
20.4	Back-hand	103.0
21.6	Mixed Writing	102.0

E. *Average deviation from the median.*

One Minute		Five Minutes
3.669	Vertical Writing	16.3338
3.077	Medium Slant	14.2880
3.255	Extreme Slant	14.2130
5.107	Back-hand	20.7200
3.904	Mixed Writing	17.6970

F. *Spacing.*

The percentages are found by dividing the number of papers in each classification (close, medium, open) by the total number of papers in each type of writing.

Percentage of cases			
	Close	Medium	Open
Vertical Writing.....	37%	63%	
Medium Slant.....	43%	53%	4%
Extreme Slant.....	45%	48%	7%
Back-hand.....	33%	67%	
Mixed Writing.....	44%	54%	2%

G. *Arrangement.* (In terms of per cent.)

	Close	Medium	Open
Vertical Writing.....	.19	.54	.27
Medium Slant.....	.39	.43	.18
Extreme Slant.....	.52	.37	.11
Back-hand.....	.27	.46	.27
Mixed Writing.....	.39	.46	.15

H. *Size of letters.*

	Small	Medium	Large
Vertical Writing.....	.40	.56	.04
Medium Slant.....	.31	.60	.09
Extreme Slant.....	.35	.56	.09
Back-hand.....	.20	.73	.07
Mixed Writing.....	.37	.47	.16

I. *Hand position.* (Percentage of cases.)

	Loose	Cramped	Peculiar
Vertical Writing.....	.40	.60	.08*
Medium Slant.....	.52	.48	.02*
Extreme Slant.....	.56	.44	
Back-hand.....	.40	.60	
Mixed Writing.....	.54	.46	

* Counted twice.

J. *Movement.*

	Free	Arm	Free-arm
Vertical Writing.....	.54	.44	.02
Medium Slant.....	.45	.49	.06
Extreme Slant.....	.40	.48	.12
Back-hand.....	.60	.40	
Mixed Writing.....	.48	.49	.03

K. *Sex.*

	Male	Female
Vertical Writing.....	31%	69%
Medium Slant.....	55%	45%
Extreme Slant.....	56%	44%
Back-hand.....	33%	67%
Mixed Writing.....	47%	53%

L. *Average Age.*

	Male	Female
Vertical Writing..	12 years, 2 months	12 years, 2 months
Medium Slant...	12 " 8 "	12 " 7 "
Extreme Slant...	12 " 11 "	12 " 8 "
Back-hand.....	13 " 3 "	12 " 8 "
Mixed Writing...	13 "	12 " 10 "

SUMMARY

A. *Legibility*

1. Of the five styles of handwriting, vertical writing is the most legible.

2. Writing having extreme slant is the least legible.
3. Back-hand, which may be considered as a variation from vertical writing, holds rank in legibility next to vertical writing.
4. Mixed writing, in which 85% of the cases of variation are variations of vertical writing, is 4.26 per cent. more legible than extreme slant. It is only thirty-eight hundredths of one per cent. less legible than medium slant.
5. Medium slant is 9.76 per cent. less legible than vertical writing.

B. *Speed*

The medians show:

1. Extreme slant to be the type of writing most rapid in the one-minute test and back-hand to be the slowest.
2. Back-hand to be the most rapid in the five-minute test and vertical writing to be the slowest.
3. Extreme slant, in the one-minute test, to be only .1 of one word more rapid than vertical writing and only .2 of one word more rapid than medium slant.
4. Vertical writing to be .1 of one word more rapid than medium slant and .3 of one word more rapid than mixed writing.
5. Mixed writing, in the five-minute test, to stand second in the highest rating for speed.
6. Medium slant to be 2.4 words more rapid than vertical writing and 4.9 words slower than extreme slant.
7. Mixed writing to be one word slower than back-hand and only one-tenth of a word faster than extreme slant.

C. *General Averages*

1. Back-hand is the most rapid in both tests and vertical writing is the slowest.
2. Vertical writing is slower than medium slant by 1.4 words in the one-minute test and 4.5 slower in the five-minute test.
3. Extreme slant is .6 words more rapid than medium slant in the one-minute test and 5.6 words more rapid in the five-minute test.

D. *Average Deviations*

1. Back-hand, by the average deviations, is shown to be the least dependable, the least stable in both tests.
2. Medium slant has the least deviation in the one-minute test and is second in the five-minute test.

3. Extreme slant has the least deviation from the median in the five-minute test, and only .18 of a word more deviation than medium slant in the one-minute test.
4. Mixed writing has the most deviation in both tests, except in the case of the samples of back-hand.
5. Both medium slant and extreme slant have, in the five-minute test, from 2.1 to 6.5 words less deviation than vertical writing, back-hand, or mixed writing.

E. Spacing

1. Vertical writing and back-hand—the most legible style of writing, show medium spacing respectively in 63 per cent. and 67 per cent. of all cases.
2. In medium slant 53 per cent. and in extreme slant 48 per cent. of the cases are medium spacing.
3. Back-hand, ranking second in the rating for legibility, has 67 per cent. of the cases in medium spacing: mixed writing shows 54 per cent.

F. Arrangement

1. Vertical writing shows in the arrangement of the words only 19 per cent. in close arrangement, while 27 per cent. of the cases are open in arrangement, and 54 per cent. medium.
2. Back-hand ranks next to vertical writing in the number of cases with medium and open arrangement, as also in the number of the cases in close arrangement.
3. Extreme slant—the least legible writing, has the largest per cent. of cases (52 per cent.) in close arrangement. Only 37 per cent. of the cases in this classification are in medium arrangement, and 11 per cent. in open arrangement.
4. Medium slant shows 39 per cent. of the cases in close arrangement, 43 per cent. in medium arrangement, and 18 per cent. in open arrangement.

G. Size of Letters

1. Sixteen per cent. of the cases of mixed writing are written with "large" letters.
2. Seventy-three per cent. of the cases written in back-hand have letters of "medium" size. Medium slant has 60 per cent, and both vertical writing and extreme slant 56 per cent. each, in "medium" size letters.

3. The writing showing the least number of cases (20 per cent.) with "small" letters is back-hand, while next to it is medium slant with 31 per cent. Extreme slant has 35 per cent. of the cases. Vertical writing has the smallest percentage of papers written with "small" letters.
4. The "size" of the letters has less effect on legibility than does "spacing" of the letters, or the "arrangement" of the words.

H. *Hand Position*

1. Both vertical writing and back-hand show 60 per cent. of the cases in the cramped position of the hand.
2. Extreme slant has the largest per cent. (54 per cent. of cases in which the hand position is "loose.")
3. Mixed writing shows 54 per cent. of the cases to be "loose": medium slant shows 52 per cent.

I. *Movement*

1. Back-hand, which is the most rapid writing according to the tests, shows the largest percentage (60) of cases written "free" hand. Next to back-hand is vertical writing with 54 per cent. of the cases.
2. Extreme slant has the lowest percentage (40) of cases written with "free" hand but shows 48 per cent., next to the highest percentage, with "arm" movement. It shows the largest number of cases (12 per cent. written with "free-arm.")
3. Back-hand shows the lowest percentage (40) of cases written with "arm" movement, but, between the lowest and the highest percentage, the difference is only 9 per cent.

J. *Sex*

1. The largest percentage of pupils using the vertical writing (69 per cent.), and back-hand (67 per cent.), were girls.
2. The largest percentage of pupils (56 per cent.) using the extreme slant, and the medium slant (55 per cent. are boys.
3. Of the pupils using mixed writing 53 per cent. are girls

K. *Age*

The noticeable feature relative to the age of the pupils who participated in the tests is the fact that the oldest children (13

years being the age for the boys and 12 years and 10 months being the age for the girls) write a mixed hand. As mixed style in writing may be considered evidence of instability in the writer, this fact, in the case of the children entering adolescence, is exactly what the psychologist would expect to find in the samples of handwriting at this stage of development.

A. Legibility. (Notice 'C' under XI.)

Vertical Writing

Back-hand

Medium Slant

Mixed Writing

Extreme Slant

B. Speed. (From the median in the 5-minute test.)

Back-hand

Mixed Writing

Extreme Slant

Medium Slant

Vertical Writing

RÉSUMÉ

C. Factors for Legibility.

1. Arrangement. (Distance between consecutive *words* in the same line.)
2. Spacing. (Distance between consecutive *letters* in the same word.)
3. Size of letters.
4. Habitual attention to details. (An inference.)

D. Factors for Speed.

1. Arm movement.
2. Loose-hand position. (Varying conclusion.)
3. Sex differences. (Both in legibility and in speed the percentage of pupils in the ranking groups are girls. Girls may be more sensitive to the directions which in this case specifically state that speed and legibility would be considered.)
4. Age. (The oldest pupils were in the ranking groups for speed.)

E. Equating Values. (Questions.)

1. Is 10 per cent. (9.76 per cent. appearing in vertical writing over medium slant) in legibility more worth striving for in teaching penmanship, than are 3 words (2.4 words appearing in the comparison of medium slant with vertical writing per five minutes) in speed of writing?

2. Can the factors be utilized in both instances to secure improved legibility and greater speed, regardless of the type of slant of the letters?

COMMUNICATIONS AND DISCUSSIONS

FORECASTING SUCCESS IN PRACTICE TEACHING

The problem which led to this study grew out of a situation where a much larger number of people applied for opportunities to do practice teaching than could be accommodated with the facilities available. Under these conditions it was necessary to reject some of the applicants. After very rigorous standards had been laid down with respect to preparation, it was found that some of those who had met these requirements had to be left out. To meet this situation a scheme of rating, based mainly on scholarship and partly on personal opinion, was devised and the candidates were given opportunities for practice teaching in the order of the excellence of their ratings. Some of those who were rated high on this *a priori* scheme did poorly as practice teachers while others, rated rather indifferently, showed an excellent quality of teaching. Consequently it was decided to compare the various items of the rating scheme to find those most closely correlated with the results secured in the practice teaching so that a more adequate system of rating might be devised.

Items Used

The various facts about the different student teachers, which were used in the rating scheme or were secured for this study, include information on the following points: General scholarship, amount of work completed in the subject to be taught, scholarship in this subject, instructor's opinion on the question, "Is the student sufficiently familiar with this subject to teach it?" opinions of the instructors with respect to the students' probable teaching success, students' marks in general methods course, and accomplishment of students in several mental tests.

Results

It was found extremely difficult to secure an adequate comparative rating of the results of the practice teaching. The supervisors rated the teachers in the different subjects on different standards so that the same quality of teaching received different ratings in the various subjects. Forty-four of the practice teachers did their work in the college academy while one was a substitute teacher in the city high school. The teaching was done in Latin, French, German, English, history, algebra, and physics. Because of these factors it was decided finally to divide the student teachers into four groups, excellent, good, fair, and poor, thus equalizing the differences between supervisors as

far as possible so as to put all on the same basis. This could be done roughly by the writers since they saw each of the student teachers at work on one or more occasions. This gave ten students rated as excellent, thirteen as good, seventeen as fair, and five as poor. These ratings are rather inadequate and, as far as they are such, tend to reduce the coefficients of correlation.

The use of the item, scholarship, in the original rating scheme, tended to eliminate students who were of poor scholastic ability and gave a rather homogeneous group in this respect. This fact reduces the presented correlation between scholarship and teaching success because it gives the items of personality a chance to exert more influence. Hence, although general scholarship and scholarship in the subject to be taught are but slightly correlated with success (Tables I and II), it is not just to conclude that scholarship and teaching success are not correlated closely in general. Other studies have shown such to be the case.

TABLE I.*

*Correlation Between General Scholarship
and Success in Practice Teaching*

SUCCESS IN PRACTICE TEACHING

Points in General Scholar- ship	Poor	Fair	Good	Excel- lent
2.90.....		1	1	1
2.80.....			1	
2.70.....			1	
2.60.....			1	1
2.50.....	1	1	1	3
2.40.....		2		
2.30.....				
2.20.....	1	1	1	2
2.10.....		1		
2.00.....		2		
1.90.....		1		
1.80.....		1	1	
1.70.....		1		
1.60.....		2	2	1
1.50.....				
1.40.....			1	
1.30.....		2		
1.20.....	1	2		
1.10.....			1	
1.00.....		1		

$r = .243 \pm .10$
 $n = 39$

* Complete data were not available for any one table. Hence no table contains the entire group of students.

TABLE II.

*Correlation Between Major Scholarship
and Success in Practice Teaching*

SUCCESS IN PRACTICE TEACHING

Points in Major Scholar- ship	Poor	Fair	Good	Excel- lent
3.00.....	1	2	1	
2.90.....		1	1	1
2.80.....	1		1	1
2.70.....				
2.60.....		2		4
2.50.....		2	2	1
2.40.....	1	3	1	
2.30.....			2	1
2.20.....			1	
2.00.....		2		1
1.90.....				
1.80.....		1		
1.70.....				
1.60.....	1	2		1
1.50.....	1			

$r = .19 \pm .10$
 $n = 40$

The course in general methods was given in such a manner that ability to apply the items of method was emphasized. This seems to have resulted in a situation much like that confronting the practice teacher, for there is a rather significant correlation between the mark secured in general methods and the success in practice teaching. (Table III.)

TABLE III.

Correlation Between Mark in General Methods and Success in Practice Teaching

SUCCESS IN PRACTICE TEACHING				
Mark in General Methods Course	Poor	Fair	Good	Excellent
A.....		2		7
B.....	2	6	10	3
C.....	1	5	2	3
D.....	1	1		
$r = .571 \pm .07$				
$n = 40$				

There was no apparent correlation between the amount of work completed in a subject and the ability to teach that subject. This may be explained by the fact that many college courses help a teacher but little in teaching high school courses, at least during the apprentice period. This was noticeable in the case of several students who were well prepared to teach their particular high school subjects although they had a minimum of the college work. This means that one's preparation to teach a particular high school subject is not measured adequately by the number of hours of work completed in that subject in college.

The other data proved to contain nothing of value. The mental tests were inadequate as administered and did not help in the matter. The opinions of the instructors were favorable in all but two instances and these were individuals who proved to be surprisingly successful.

Conclusions

On the basis of the above data and the general impressions which the writers received from the study it is suggested that a plan be tried for rating prospective practice teachers which will base one-third of the rating on general scholarship, one-third on mark secured in the general methods course, and one third on preparation in the subject to be taught, as evinced by accomplishment in an examination given in that high school subject. This examination should test acquaintance with the material and ability to organize it from the teacher's point of view.

A. R. MEAD and C. E. HOLLEY.

Ohio Wesleyan University.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

INCLUDING EXPERIMENTAL PEDAGOGY, CHILD PHYSIOLOGY
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EDITORIAL

The increasing appreciation of the value to society of the creative artist gives point to the inquiry regarding the fundamental characteristics of artistic endowment. It is popularly believed that the painter is predominantly eye-minded, and that the musician, especially the creative musician, the composer, is strongly ear-minded. Recently the director of music in a large state university complained of his class in harmony because, as he said, they were so lacking in the ability to hear mentally the melodies and harmonies they were trying to write. Yet this class was a highly selected group, in that the students had elected the course in spite of its reputation for difficulty, and admission to the course presupposed a considerable degree of musical ability. It would be interesting to know with some degree of certainty whether these students had any greater or less ability to hear mentally the melodies of which they thought than their fellow students of inferior musical ambitions. William James, who was a painter of no mean attainments as well as a psychologist, affirmed that he was a very poor visualizer, and quoted with approval Galton's statement that persons with.

distinctly defective visual imagery may "become painters of the rank of Royal Academicians." It is not improbable that eminent composers have no more vivid auditory imagery than non-musical individuals.

The recent elaborate study of motor imagery by Dr. Richard Baerwald (see this JOURNAL, May 1916, p. 306) throws some interesting light on the relation between musical ability and motor activities. Many people of high musical attainments find it impossible to appreciate or do justice to a new musical production, no matter how simple, on first hearing. After a lapse of time, however, or on a second hearing, even very difficult music is found to have cleared up and become perfectly comprehensive. In all cases studied, this musical illumination was found in conjunction with a well-defined motor disposition, and the phenomenon was attributed to the development of motor attitudes which reinforce the satisfaction produced by the musical ideas. On the more fundamental question whether the development of skill in musical performance is in any way dependent on the degree of native motor endowment, the author's findings are negative. Musical people show a more decided tendency to react by involuntary movements (starting, crying out, etc.) to unexpected stimuli, as loud sounds, contacts on the skin, or the sudden appearance of objects, but in other respects there was as large a proportion of strongly motor individuals among the non-musical as among the musical.

What is urgently needed is a more extensive study of the artistic endowment of school children along the lines suggested for musical ability by Seashore in his book "*Psychology in Daily Life*," and a careful checking of the results of such tests on the basis of subsequent training. Society cannot afford to allow any potential artistic power to be wasted. One of the clearest lessons of the present war is the necessity of conserving and utilizing native resources, and there is no resource more significant for society as a whole than creative artistic talent. The day is not far distant when the public will demand much more from the schools than routine training in a few technical subjects. It calls even now for an intensive study of the pupil, and a development of his potentialities to the best interests of himself and of his fellows. To this end the discovery of artistic endowments will be an important contribution.

J. C. B.

NOTES AND NEWS

Under the supervision of Dr. H. H. Goddard of Vineland, N. J., the various scattered papers of A. Binet and Th. Simon on the development of intelligence and on the intelligence of the feeble-minded have been collected and translated into English by Miss Elizabeth S. Kite. No writer in any country has so stimulated interest in the scientific study of the development of intelligence as Binet, and while investigators may cavil at the details of his work, those who read these volumes will admit that he showed a wonderful grasp of the problems of mental retardation. American students will be grateful to Dr. Goddard for making these papers accessible.

The committee appointed by the N. E. A. at the Detroit meeting "to study methods of promoting the ideal of racial well-being" announces that through the generosity of an anonymous donor a series of prizes will be offered amounting to \$1000 a year for four successive years to graduating classes in state normal institutions for the best co-operative study of the proposition "The supreme object of education should be to make the next generation better than living generations." The object of these contests is to familiarize young teachers with recent studies in mental heredity, and the movement deserves the heartiest encouragement of all students of education.

Through the efforts of Dr. Clinton P. McCord, president of the Albany Social Service Science Society, the criminal courts of Albany have been applying modern methods of psychological examination and expert analysis of mental capacity and moral weakness in dealing with the culprits brought before them. Judge Addington recently stated that he considered these examinations by a trained psychiatrist of tremendous importance in arriving at a proper and scientific disposition of criminal cases. It is to be hoped that this may result in a permanent psychopathic laboratory for the city and county of Albany.

The Boston police department has recently established a psychopathic clinic for the examination of offenders. The clinic is under the charge of Dr. Victor V. Anderson.

Funds have been contributed which make possible the continuance of the psychopathic laboratory at the New York City police headquarters. This laboratory was opened last December in order to

cull from the prisoners each day those who were mentally defective and to send them to suitable institutions.—*Science*.

In the survey of the St. Louis public school system during the past summer special attention was given to the course of study and the instruction in the elementary school subjects. Professor C. H. Judd, the director of the survey, had as his assistants Dr. Frank N. Freeman in the subject of penmanship, Mr. John B. Cragun in music, Mr. William S. Gray in reading, and Dr. J. Franklin Bobbitt in related topics.

The General Education Board has completed a survey of the Gary schools under the direction of Dr. Abraham Flexner and Dr. Frank P. Bachman, assisted by a large staff of specialists. The publication of the details of this survey will be awaited with interest.

As a part of the social service program of the Ohio State University Y. M. C. A., volunteer probation work, which had its origin in December, 1915, will be carried on during the coming year on a larger scale. During the past year ten men students were picked to assume charge of delinquent boys, who were probated to their charge by the juvenile court authorities. Most of the boys were first offenders, although in one or two cases they were chronic trouble makers. Not a single boy has since been returned to the court charged with an offense.—*School and Society*.

Dr. Josiah Royce, Alvord professor of the history of philosophy at Harvard University, died on September 14, in his sixtieth year. Dr. Royce was probably the leading authority on idealistic philosophy in the world, and stimulated the study of educational psychology by the suggestive treatment of sensitivity, docility and initiative in his *Outlines of Psychology*.

At the Western Reserve University, Dr. James Crosby Chapman has been promoted to be associate professor of experimental education.—*School and Society*.

Miss Florence E. Bamberger, M. A. (Columbia), has been appointed instructor in education in the Johns Hopkins University.—*School and Society*.

William T. Sanger, Ph. D. (Clark), formerly professor of philosophy and pedagogy at Bridgewater College, has entered upon the work of registrar and professor of education at the State Normal School, Harrisonburg, Virginia.

PUBLICATIONS RECEIVED

(Notice in this section does not preclude a more extended review later)

National Society for the Study of Education. The Fifteenth Yearbook.

Part I. Standards and Tests for the Measurement of the Efficiency of Schools and School Systems. Chicago: University of Chicago Press, 1916. Pp. 172. 75 cents.

This number of the Yearbook contains the report of the National Council of Education, of the National Educational Association, on *Standards and Tests of Efficiency*. Chapters in the report are A Measuring Scale for Physical Growth and Physiological Age, by Bird T. Baldwin; Notes on the Derivation of Scales in School Subjects, with Special Application to Arithmetic, by B. R. Buckingham; Score Card for City School Buildings, by George Drayton Strayer; Completion Tests for Public-School Use, by M. R. Trabue; Tests in the Boston Public Schools, by Frank W. Ballou; Courtis Tests in Arithmetic; Value to Superintendents and Teachers, by S. A. Courtis; Use of Standard Tests at Salt Lake City, Utah, by Ellwood P. Cubberley; Reading, by Charles H. Judd; The Effects of Efficiency Tests in Reading on a City School System, by E. E. Oberholtzer; Investigation of Spelling in the Schools of Oakland, California, by J. B. Sears; Standard Tests as Aids in the Classification and Promotion of Pupils by Daniel Starch; and The Use of Mental Tests in the School, by Guy Montrose Whipple.

ARTHUR C. PERRY. *Discipline as a School Problem.* Boston: Houghton, Mifflin Company, 1915. Pp. xii, 273. \$1.25.

In this book the problem of discipline is considered from three different angles: as an individual problem, as a class problem, and as a school problem. In the first few chapters the author develops rather dogmatically a popular psychology, including such standard topics as intellect, feeling, will, heredity, environment, stages of development, babyhood, childhood, and adolescence. Except as a general philosophy of behavior this portion of the book seems to have only a vague bearing on the subject of school discipline. In Part Two we begin to come to closer quarters with our problem in that the author considers the psychology of class control, the equipment of the teacher as a disciplinarian, conditions favorable to good control, the recognition of age, teaching method, and rewards and punishments. Only in Part Three do we really reach the significant discussion of discipline as a school problem. Five of these chapters deal with the various relations of the principal to his environment, and only two deal with what would seem to be the most vital thing of all, the analysis of cases. The book is very generally conceived and the experienced school teacher will find little that is novel in it. As for the inexperienced teacher the question may well be asked whether the secrets of good discipline can ever be taught.

- W. PETERS. *Ueber Vererbung psychischer Fähigkeiten*. Reprinted from *Fortschritte der Psychologie und ihrer Anwendungen*. Volume 3, Nos. 4-6, 1915. Pp. 185-382.

This elaborate statistical and experimental study on the inheritance of mental capacities is noteworthy for biology, psychology, and education. The first forty pages are devoted to a statement of the problems of mental heredity and a review of the literature on the subject. Of particular interest is the section on Mendel's principles in mental heredity. The author then presents a description of the material which he used in his investigations, consisting of the school marks in the schools of small towns where the population has remained almost undisturbed and the school records have been preserved for at least three generations. The school subjects considered include reading, writing, number, the mother tongue, religion, object lessons, and singing. Besides these grades the author had access to the records of the teacher's judgments on the general capacity, the industry, and the conduct of their pupils. From the point of view of sex differences the girls make the best showing in reading, writing, mother tongue, religion, singing, industry and conduct. The boys on the other hand, both in the younger and older generations, make slightly the better showing in number work and in nature study, while in capacity they take about the same rank. The author finds convincing evidence of inherent connection between the marks of parents and children, and of grandparents and grandchildren, and after examining this connection from all possible points of view concludes that it affords ample proof of mental heredity.

- JOSEPH B. PIKE. *Bulletin for Teachers of Latin*. Minneapolis: University of Minnesota, 1915. Pp. 14. 25c.

Perhaps the most interesting portion of Professor Pike's monograph is his discussion of the direct method of teaching Latin. There is a helpful list of lantern slides, books for general reading, pedagogical aids, and a general bibliography.

- Report of the Public Schools of the City of Dallas, Texas*. 1915. Pp. 153.

Pages 41-77 of this report contain excerpts from the report of a survey of instruction in English and mathematics in the elementary schools of Dallas by E. D. Jennings. This survey included the application of tests in arithmetic, spelling, reading, and composition to over 8,000 pupils. The spelling tests made use of the Buckingham scale, the compositions were rated on the basis of the Hillegas scale, and the Starch reading tests were used. Tables are printed showing the average number of words read and words reproduced for each grade of each school, and for the compositions the number of words written and the score on the basis of the Hillegas Scale.

Report of a Survey of the Public Schools of Leavenworth, Kansas. Conducted by the Bureau of Educational Measurements and Standards, Kansas State Normal School, Emporia, 1915. Pp. 202.

The survey presents a general account of Leavenworth and its public schools, discusses the school board, buildings and equipment, finances, the teaching staff, the course of study in both the elementary and high schools, and the relation of the schools to the community. In the study of the work done in the special school subjects the Courtis arithmetic tests, Series A, No. 7, were used with the four upper grades. The quality of the pupil's handwriting was determined by the use of the Thorndike scale. Their spelling was rated by the Buckingham Scale and specially devised tests in grammar and composition were used. The only high school subject in which scientific testing was attempted was algebra, in which the Monroe Tests were given.

Report on the Work of the Bureau of Education for the Natives of Alaska, 1913-14. Bulletin, 1915. No. 48. Washington: Bureau of Education. Pp. 52.

There is a general account of the condition of the natives in Alaska, and a special report from each school. There are numerous illustration and an excellent map.

CARL E. SEASHORE. *A Child Welfare Research Station.* Iowa City: University of Iowa, January 15, 1916. Pp. 18.

The proposed Child Welfare Research Station which it is hoped will be established at the University of Iowa this winter includes six sections: The present paper describes the work of each of these sections, and points out its significance to the people of the state. Section One deals with heredity and pre-natal care; Section Two, nutrition and the child; Section Three, preventive medicine; Section Four, social surveys; Section Five, education and morals; Section Six, applied psychology. There will also be an extension division, the work of which will be to get the results of the research divisions before the attention of the people.

STEPHEN SMITH. *Who is Insane?* New York: The Macmillan Company, 1916. Pp. 285. \$1.25.

In 1882 when the veteran author of this book was appointed State Commissioner of Lunacy for New York, Governor Cornell stated that there was a popular and growing belief that many inmates of the asylums for the insane were sane, but had no opportunity to relate their grievances except to officers who paid no attention to them. Therefore, the governor urged the new commissioner always to keep in mind the question, who is insane? This question, and the attempts of an active and busy physician to answer it, furnish the key-note of the book. Part One considers the nature of insanity; Part Two the

critical periods of life predisposing to insanity; Part Three the care and treatment of the insane; Part Four, the feeble-minded and criminal, and Part Five the dawn of a better day. The book is largely personal and reminiscent, and could scarcely be said to contribute greatly to our knowledge of insanity.

AMBROSE L. SUHRIE. *The Inductive Determination of Educational Method*. Baltimore: Warwick and York, 1915. Pp. 57. 75c.

The sub-title of this little book is "The Standardization and Application of Efficiency Tests to any of the Numerous Factors of Educational Method Which Now Dominate Class Room Teaching Processes or Which May be Made to Contribute to their Greater Efficiency." This sub-title is somewhat pretentious when compared with the contents of the book. There are no tests standardized or applied to educational method, but there is an outline of how to go about such standardization and a discussion of the safeguards needed in an educational experiment.

JESSIE TAFT. *The Woman Movement from the Point of View of Social Consciousness*. University of Chicago Philosophic Studies, No. 6. Chicago: University of Chicago Press, 1916. Pp. x, 62. 50c.

In this monograph the author upholds the thesis that the woman movement is the expression of problems resulting from a conflict of impulses and habits, values and standards which indicate a dualism of self and social environment. The solution lies in a larger, more highly socialized, and more dynamic conception of personality. The woman movement is closely allied with the labor movement and both are manifestations of a struggle for the greater equalization of social opportunities.

LEWIS M. TERMAN. *The Mental Hygiene of Exceptional Children*. Reprinted from the Pedagogical Seminary, Volume 22, December, 1915. Pp. 539-537.

A study of the relation of school success to intelligence. Compared with his possibilities the child of exceptionally superior intelligence is almost always retarded.

LEWIS M. TERMAN. *Review of Meumann on Tests of Endowment*. Reprinted from the Journal of Psycho-Asthenics, Volume 19, Nos. 2-4, 1914-15. Pp. 75-94, 123-134, 187-199.

A valuable condensation of Volume II of the revised edition of Meumann's *Experimentelle Pädagogik*. This volume of 800 pages

is devoted almost exclusively to tests of endowment or intelligence, and very largely to the Binet Tests. An appendix presents Meumann's Test Series arranged for use in Hamburg.

BEVERLEY R. TUCKER. *Nervous Children*. Boston: Richard G. Badger, 1916. Pp. 147. \$1.25.

This book contains chapters on the nervous system, heredity and environment, nervous and mental development, habit, sex hygiene, the cause and prevention of nervousness, the training of nervous children, feeble-mindedness, and nervous and mental diseases of childhood. The discussion is from the medical point of view throughout, and presents nothing new for the psychologist. Whether it will be of value to the layman may be open to some question.

EDWARD BRADFORD TITCHENER. *A Beginner's Psychology*. New York: The Macmillan Company, 1915. Pp. xvi, 362. \$1.00.

This book may be said to take the place of the author's Primer which, we are informed, will not be further revised. The book is changed throughout, entirely rewritten, and the emphasis shifted from knowledge of subject-matter to point of view. The drift of the discussion may be seen by the chapter headings which are: psychology—what it is and what it does; sensation; simple image and feeling; attention; perception and ideas; association; memory and image; instinct and emotion; action; thought; sentiment; and self and consciousness. The introductory chapter of forty pages is essentially a discussion of scientific method, and attempts to arouse in the student a desire for a thorough understanding of scientific work rather than an exposition of the bases of psychology. In the chapter on association, much stress is laid on the doctrine of associative tendencies, while the fundamental characteristic of memory is the feeling of familiarity. The James-Lange theory of the emotions is presented, and reference is made to the recent work of Cannon which has proven this theory inadequate. The book is lucidly written and each chapter ends with a series of questions and exercises and a list of references to the most important works on the topic.

H. B. WILSON AND G. M. WILSON. *The Motivation of School Work*. Boston: Houghton Mifflin Company, 1916. Pp. ix, 265. \$1.25.

This book should be of distinct aid to elementary school teachers. Part One is a discussion of motivation in general, indicating the need for motivation, its psychological basis, and the origin and sources of motives. In Part II there is a detailed discussion of motivation in each of the following subjects: reading, language, history, geography, and arithmetic. Part III discusses the motivation of other school

subjects and gives suggestions for binding the school work together and making it function in the child's development.

A. S. WHITNEY. *Status of Superintendents, Principals, and Teachers of the High Schools of Michigan*. Reprinted from the Journal of the Michigan School Master's Club, 1916. Pp. 19.

The paper presents the number of teachers in each high school, the degrees held by superintendents and teachers, the amount of experience in teaching, and the range of salaries. The author makes a strong plea for the reduction of all other expenses to a minimum so that there may be funds for increasing teachers' salaries.

ARTHUR MAYER WOLFSON. *Ancient Civilization*. Cincinnati: American Book Company, 1916. Pp. 127.

A readable little manual on prehistoric civilization, the Egyptians, the Hebrews, the Phoenicians, Greece, Rome, and the early middle ages.

HILDA A. WRIGHTSON. *Games and Exercises for Mental Defectives*. Cambridge, Massachusetts. Caustic-Claffin Company, 1916. Pp. iii, 100. \$1.25.

One hundred and fifteen games, puzzles, and constructive exercises for the education of the feeble-minded. The author claims that the exercises have been tested in long practice and that they have proved to have accomplished their object.

ROBERT M. YERKES. *Provision for the Study of Monkeys and Apes*. Reprinted from Science, N. S., Volume 43. February 18, 1916. Pp. 231-234.

A plea for the organization of a research institute to study the behavior of the primates.

ROBERT M. YERKES. *The Mental Life of Monkeys and Apes. A Study of Ideational Behavior*. Behavior Monographs, Volume III, No. 1, 1916. Serial No. 12. Pp. 145.

This monograph presents the results of experimental work carried on with two monkeys and an orang in Dr. Hamilton's laboratory and collection at Montecito, California. The body of the monograph presents the results of multiple choice experiments with the three animals, and reveals very decided individual differences in primate behavior.

C. S. YOAKUM. *The Complication Experiment and the After Image.*

Reprinted from the Journal of Experimental Psychology, Volume I. No. 2. April, 1916. Pp. 99-121.

Results with a revolving disc, that tends to destroy the after image and localize the visual factors, differ materially from those with the usual form of rotating pointer. There is a critical discussion of previous work on the complication experiment and a detailed consideration of the introspection of various subjects. The experimental analysis shows the extreme complexity of even the simplest act of perception.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

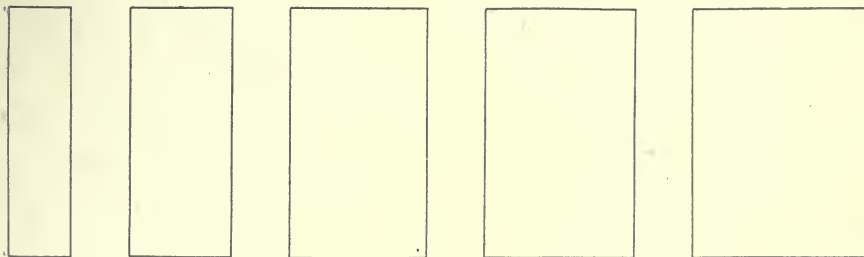
TESTS OF ESTHETIC APPRECIATION

EDWARD L. THORNDIKE

Teachers College, Columbia University

It is desirable to have means for measuring esthetic appreciation with a wide range of content, both for theoretical studies of its nature and correlations, and for such practical purposes as tests of instruction or vocational guidance. One of the most convenient means for such measurements is a graded series of known degrees of esthetic merit to be arranged in order, the person's ability being measured inversely by the sum of his deviations from the correct order. Some such graded series are presented here, together with what is known of the relative esthetic merit of each specimen in each series.

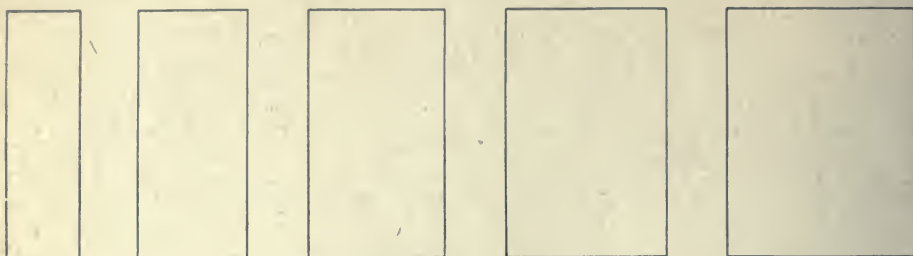
The contents of the series are not specially good for the purpose, their use for tests of esthetic judgment having been a secondary consideration. The series will be useful, however, until enough better ones are constructed.



RECTANGLES: SERIES I.

Calling the rectangles in order from left to right 1, 2, 3, 4, 5, the correct order by the consensus is 3, 4, 2, 5, 1. Of 200 judges, college juniors,

58½%	rated 3 as better looking than 4
59 %	" 4 " " " 2
69 %	" 2 " " " 5
62 %	" 5 " " " 1

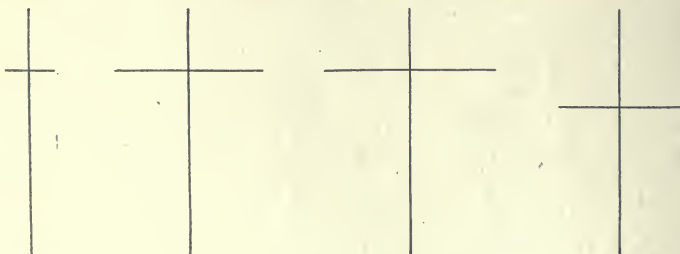


RECTANGLES: SERIES II.

Calling the rectangles in order from left to right 1, 2, 3, 4 and 5, the correct order by the consensus is 3, 2, 4, 1, 5. Of the 200 judges,

60	%	rated 3 as better looking than 2
66 $\frac{1}{2}$	%	" 2 " " " 4
63 $\frac{1}{2}$	%	" 4 " " " 1
65	%	" 1 " " " 5

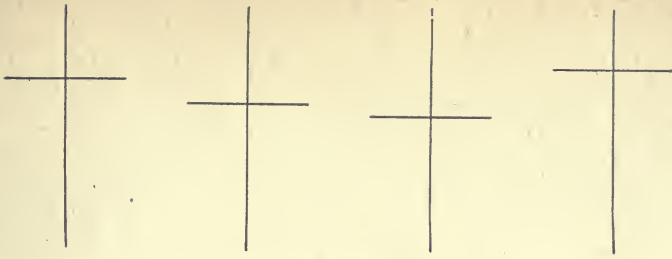
It may be noted that the 200 judges rated No. 4 of Series I and No. 2 of Series II as equally good looking, 47 $\frac{1}{2}$ % to 52 $\frac{1}{2}$ %. So also for No. 2 of Series I and No. 4 of Series II (51% to 49%), for No. 5 of Series I and No. 1 of Series II, (51% to 49%), and for No. 1 of Series I and No. 5 of Series II (51 $\frac{1}{2}$ % to 48 $\frac{1}{2}$ %).



CROSSES: SERIES III.

Calling the crosses in order from left to right 1, 2, 3 and 4, the correct order by the consensus is 3, 2, 4, 1. Of 100 college students,

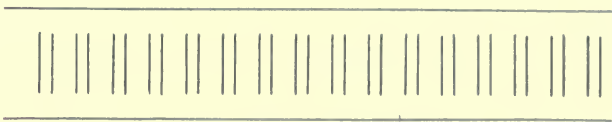
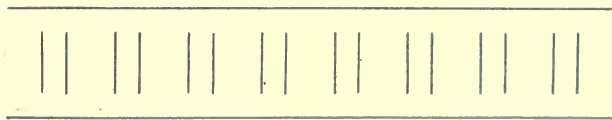
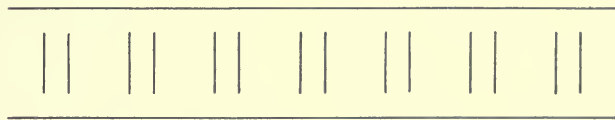
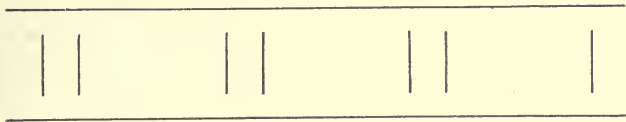
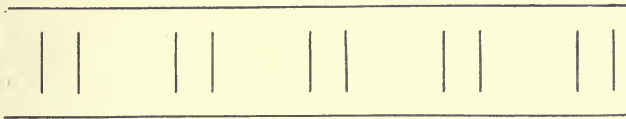
78%	rated 3 as better looking than 2
72%	" 2 " " " 4
75%	" 4 " " " 1



CROSSES: SERIES IV.

Calling the crosses in order from left to right 1, 2, 3 and 4, the correct order by the consensus is 4, 1, 2, 3. Of 100 college students,

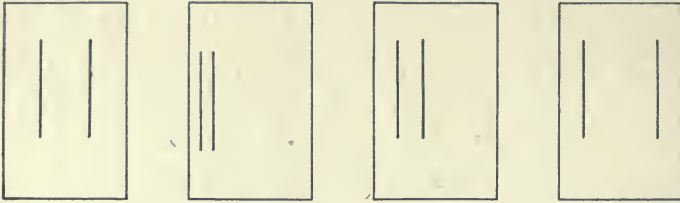
69%	rated 4 as better looking than 1
76%	" 1 " " " " 2
82%	" 2 " " " " 3



DESIGNS: SERIES V.

Calling the designs in order from top to bottom 1, 2, 3, 4 and 5, the correct order by the consensus is 3, 4, 1, 2, 5. Of 200 college students,

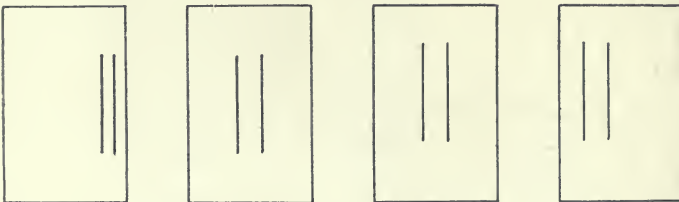
62½%	rated 3 as better looking than 4
73%	" 4 " " " " 1
72%	" 1 " " " " 2
67½%	" 2 " " " " 5



DESIGNS: SERIES VI.

Calling the designs in order from left to right 1, 2, 3 and 4, the correct order by the consensus is 1, 4, 3, 2. Of 200 college students,

66%	rated 1 as better looking than 4
74%	" 4 " " " " 3
73%	" 3 " " " " 2



DESIGNS: SERIES VII.

Calling the designs in order from left to right 1, 2, 3, 4, the correct order by the consensus is 2, 3, 4, 1. Of 200 college students,

63%	rated 2 as better looking than 3
73%	" 3 " " " " 4
69%	" 4 " " " " 1

In using these tests the instructions may be simply for each series: "Examine these rectangles (crosses, designs). Mark the one which you think is the best looking 1; mark the one which you think is the next best looking 2, and so on for 3 and 4 (3, 4 and 5)."

In scoring the results, the simple method of counting the sum of displacements from the correct order will be adequate for most of the purposes for which the tests will be used.

For a more exact scoring, the entire experiment may be treated as if it were a series of comparisons of pairs and the results evaluated as in a regular "right and wrong cases" experiment. The tests are, however, not extensive enough for convenient treatment by this method.

Appreciation of the Quality of a Line of Poetry Written to Complete a Couplet, the First Line Being Given

The test consists in ranking in order of merit seven or more lines, each a completion of the same first line as in the specimen case shown below.

First Line: *But still he only saw and did not share.*
 Completions: He could not tell us what he did there.
 Tho longing to join, he did not dare.
 He merely felt, but did not care.
 He feared his virgin deed to do and dare.
 The others pleasure, nor did he care.
 His saddened heart, still wand'ring, was not there.
 Her varied toil, her deep and heavy care.
 The fun and frolic of the village fair.

The sets of lines to be ranked are either 7 or 13 in number. The sets of thirteen duplicate the sets of seven, plus six interspaced degrees of merit, and need be used only for very good judges who rank the more widely spaced sets perfectly, or nearly so.

The sets are so chosen that the differences in merit are roughly equal in so far as the opinions of thirty persons of general education can be accepted as giving just measures of the merit of a line of poetry. If the test in general proves useful, lines with exactly equal steps of difference in merit can be provided by having many lines written and ranked by judges whose competence is beyond dispute.

The present sets were obtained and graded as follows:

Sixty adults wrote lines to complete certain given lines. Thirty persons of general education and cultivation rated all the sixty completions for a given line, in general calling the worst six 1, the next worst six, 2, and so on. They did not use the grades 1 to 10 absolutely for successive sixes, however, but were free to make their division 5, 7, 6, 6, 4, 8, or other approximations to 6. The

sum of the grades given by the thirty to each line was obtained. Lines were chosen to make sets whose sums of grades differed successively by approximately 30. These form the sets of seven lines. Interspersed lines were chosen whose sums of grades were such as to make the successive differences approximately 15. The number of judges out of thirty whose rankings put each line above, equal to, and below its neighbor in the set of seven, was then determined for each set of seven.

It appears that the differences of the sets are a trifle smaller as we pass from poorer to better lines. But the discrepancies are very slight and may be disregarded until sets selected on the basis of rankings by experts are available.

The sets to be used as tests are given below, each arranged in a random order, just as they should be given in practice. Keys showing the presumably correct order are given in Table I, which contains also the facts concerning the sums of grades and judgments of better, equal and worse obtained from the thirty judges.

The keys include the facts for some extra lines which are given below. These lines will not be used in tests of judgment but may be of service when the sets are used as rough provisional scales to score the quality of lines written to complete couplets.

A, First line—But still he only saw and did not share.

AI primary

- A 3—His saddened heart still wand'ring was not there.
- 12—Though longing to join her did not dare.
- 13—He could not tell us what he did there.
- 31—He feared his virgin deed to do and dare.
- 37—Her varied toil, her deep and heavy care.
- 44—He merely felt, but did not care.
- 49—The other's pleasure, nor did he care.

AI interspaced

- A 8—The life about him, the atmosphere.
- 16—To see is not to share, else love were fair.
- 27—For his own thoughts engrossed his every care.
- 28—To take the joy of life he did not dare.
- 42—Was he sorry? No, he did not care.
- 60—The apparent consternation of the bear.

AII primary

- A 1—And action ever complements the dare.
- 22—The joys which youth alone can see.
- 25—And, damned of seeing, was of comfort bare.
- 35—For all the world to him was but a snare.
- 37—Her varied toll, her deep and heavy care.
- 47—In him the action brought forth no response.
- 56—Devoutly tall, divinely short, discreetly rare.

AII interspaced

- A 4—His crime is only that he loved the fair.
- 8—The life about him, the atmosphere.
- 27—For his own thoughts engrossed his every care.
- 28—To take the joy of life he did not dare.
- 36—For he did not wish to partake of another's care.
- 41—A passing thought, for yet he did not care.

AIII primary

- A 5—The horrors rampant there.
 11—The opportunities which are so rare.
 33—The happiness that he had gathered there.
 37—Her varied toil, her deep and heavy care.
 39—Her beauty, her charm, her glare.
 54—"There ain't no core," she said, "to this here pear."
 59—The beauteous rag of bone and hank of hair.

AIII interspaced

- A 6—There yet was time to save them both, by prayer.
 21—For secrets his he could not bear.
 26—I'm sure, Sir, 'twas not he who ate the pear.
 27—For his own thoughts engrossed his every care.
 34—The laughter of the crowds—the noise and life.
 40—He only stood and watched with vacant stare.

B, First line—What she has done no tears can wash away.

BI

- B 3—The memory of her deeds will ne'er decay.
 6—What she has done nothing can make her forget.
 12—Who now do weep did not her footsteps stay.
 28—Men oft are strong, but passions sway.
 37—No grief efface the evil of that day.
 41—Nor penitence atone for, however deep.
 54—Nor can the forces of the earth repay.

BI interspaced

- B23—No hands can soothe, no mother's kiss can sway.
 24—The debt she owes, no wealth can e'er repay.
 43—But we must all forgive and let her stay.
 47—No anguish alter and no prayers make new.
 55—Nor any day bring back her quiet face.
 57—I'll never forget this dreadful day.

BII

- B 2—She thinks it can, so Monday's washing day.
 3—The memory of her deeds will ne'er decay.
 4—Nor can he afford to stay.
 10—Pain, grief and sorrow follow without delay.
 18—Nor tears nor prayers, though she prayed for aye.
 37—No grief efface the evil of that day.
 48—For memories of past will forevermore hold away.

BII interspaced

- B 8—For she has marked an immortal clay.
 22—The heart she hurt can never be made gay.
 27—As for the future, no one can say.
 40—We carve in marble, we do not mold in clay.
 51—What she has said she never can unsay.
 58—Remorse is in vain, 'twill not undo the day.

BIII

- B31—No words impassioned can his curses stay.
 33—No pow'r can change the errors of a day.
 47—No anguish alter, and no prayers make new.
 49—Deeply imprinted, it will forever stay.
 55—Nor any day bring back her quiet face.
 57—I'll never forget this dreadful day.
 60—No grief can cleanse the soul, when men betray.

BIII interspaced

- B 1—No atonement can ever repay.
 5—Bitter memories enclosed the day.
 12—Who now do weep, did not her footsteps stay.
 17—A life of penance? Yes, perchance it may.
 46—No penitence wipe out, no words unsay.
 54—Nor can the forces of the earth repay.

BIV

- B 9—For sins, like monarchs, hold their sway.
 27—As for the future, no one can say.
 29—She can but wait and watch and listen and obey.
 34—For night is night and day is day.
 36—No grief undo, no penitence allay.
 46—No penitence wipe out, no words unsay.
 58—Remorse is in vain, 'twill not undo the day.

BIV interspaced

- B 2—She thinks it can, so Monday's washing day.
 13—Remorse her portion from day to day.
 18—Nor tears nor prayers, though she prayed for aye.
 37—No grief efface the evil of that day.
 39—So cease repining and hope for a better day.
 56—Nor constant moaning can her pain allay.

C, First line—Old scenes of glory, times long cast behind.

CI

- CI8—Old hates and feuds the memory can't find.
 31—As once ago we form in line.
 41—Bring in the wake a sadness well defined.
 46—Came floating back on gusts of wind.
 47—This happy Christmas season brings again to mind.
 56—Old thoughts of love thus clearly brought to mind.
 59—The newer story brings them back to mind.

CI interspaced

- C 5—Still in the book of memory we find.
 25—Are pictured here and there and in the mind.
 27—Cast, as it were, a halo round the mind.
 40—Await to tell the story and posterity remind.
 42—Ever appear most lovely to the mind.
 57—His soul still yearns for, to prove again his power.

CII

- C 7—Come trooping to us to cheer the weary mind.
 10—Return to sight and joyful make the mind.
 19—Come back to view, as if of present time.
 22—Flit constantly before the eyes of my mind.
 34—And staged a show of different kind.
 47—This happy Christmas season brings again to mind.
 55—Return and with new challenge thrill the mind.

CII interspaced

- C 4—Rise fresh into the memory once dim.
 35—May now raise prospects in each noble mind.
 49—Those strains of music now bring to our mind.
 54—Are ever yet the solace of the poor, but hopeful, blind.
 57—His soul still yearns for, to prove again his power.
 60—Arise and make the present seem unkind.

CIII

- C 4—Rise fresh into the memory once dim.
 8—Appear once more and calm my wand'ring mind.
 13—Unfurled with battle flag and brought to mind.
 21—Portray their pictures in the canvass of our minds.
 45—Came from the hazy past slowly o'er his mind.
 53—In rapid course passed through his fevered mind.
 57—His soul still yearns for, to prove again his power.

CIII interspaced

- C 9—Comrades unforgotten, pass before the mind.
 15—Passed like magic through his mind.
 20—Oft come to memory, pure, as though refined.
 37—Come again to bind, once more around us wind.
 38—Rise up, the sluggish heart to stir once more.
 52—Come with that martial music to my mind.

D, First line—Kind self-conceit to some her glass applies.

DI

- D 6—And makes them ever noble to their eyes.
 9—To others not a glance she ever gives.
 12—To those who appear before others' eyes.
 22—But to others all her comfort she denies.
 31—Their smiling face with gladsome heart replies.
 43—Not as to those who would be wise.
 52—Shows them their faults and opens wide their eyes.

DI interspaced

- D21—And hides for them those faults that others see.
 32—And then is shocked by the vision of her eyes.
 33—Uncaring if she reveal truth or lies.
 39—For here find for whom the lad accrues.
 48—And then they lead the world in their own eyes.
 60—And lo! their stature greatly multiplies.

DII

- D19—A potion sometimes of too great size.
 23—But appears the same to no one else's eyes.
 31—Their smiling face with glad some heart replies.
 34—That truth and reality may appear.
 35—To others vain regret and patience tries.
 38—Causing many mortals to believe her lies.
 42—With roguish laugh and mischief in her eyes.

DII interspaced

- D 1—But to most men this event she denies.
 8—Smiles over wrinkles and applauds the dyes.
 11—And covers o'er a host of short comings.
 28—And fools the few who laugh at all replies.
 36—And what is large is little to her assisted eyes.
 40—And views the fair result with charmed eyes.

DIII

- D14—Which so many of her friends despise.
 27—But if repressed from others swiftly flies.
 33—Uncaring if she reveal truths or lies.
 37—And in mercy their wants supply.
 45—And all their little glories magnifies.
 48—And then they lead the world in their own eyes.
 57—Who view themselves with smiling dreaming eyes.

DIII interspaced

- D 5—And then behold without disguise.
 9—To others not a glance she ever gives.
 16—And with a rosy color shows their lives.
 22—But to others all her comfort she denies.
 31—Their smiling, face with glad some heart replies.
 55—And sees them colored by what shades her eyes.

E. First line—As clocks to weight their nimble motion owe.

EI

- E 8—So married men to make ends meet must go.
 17—Their balance to the pendulum we show.
 20—And streams to quick descents their swifter flow.
 23—So the wind will ever blow.
 29—So culture to solid grind is founded.
 41—We on our interest much dependence show.
 44—So heavy spirits make the mind to go.

EI interspaced

- E 1—One should in life avoid no toil or woe.
 13—So much to pendulums that make them so.
 15—So many a handsome fellow a sand-bag has laid low.
 28—We by ideals our own growth must show.
 40—So we by thought around the word must go.
 50—So learning to philosophy must bow.

EII

- E 2—So from our souls do prompted actions flow.
 12—So we, our rapid progress, to the strength of those who row.
 14—So we to Life owe ours.
 21—Because of burdens men the steadier go.
 37—Ships on the sea by some power go.
 44—So heavy spirits make the mind to go.
 49—Perhaps we too by faults may faster grow.

EII interspaced

- E 6—Their use to balanced motion to and fro.
 10—Their power to shapeless mass that hidden lies below.
 11—Mortals, ambition laden, come and go.
 19—So time moves on at rapid gait or slow.
 26—So mental ballast helps the thoughts to flow.
 57—So we for joy to others' sorrow go.

F, First line—The forests dance, the rivers upward rise.

FI

- F18—Reaching, it seems, to Paradise.
 21—His thoughts no mortal could even surmise.
 22—The mountains soar above them to the skies.
 24—The statue upward turns his nose and toes.
 33—And spring, sweet, lovely, longed-for spring is here.
 40—For here the flood in all its strength did rage.
 52—The birds awake, their songs reach to the skies.

FI interspaced

- F 8—The bird-notes mingled with the children's cries.
 9—In frenzied gladness toward the darkened skies.
 14—When the storms and rains greet us with surprise.
 26—What is the matter, do you think with that man's eyes.
 47—The earth a scroll is rolled into the skies.
 57—For spring brings new life and added size.

FII

- F 5—And blinking stars wink on this paradise.
 10—And give to youthful eyes a glad surprise.
 12—The birds sing songs; the animals grow wise.
 20—Birds seek the water's depths: the porpoise flies.
 27—The birds awake and earth is paradise.
 28—In sheer unspeakable rapture so sweet.
 45—And fleecy clouds sweep on across the skies.

FII interspaced

- F 4—To join the breathless frolic of the May.
 13—The mists melt; upon the hills the sunlight lies.
 37—As though all nature were now despised.
 51—A flood of summer sunshine fills the skies.
 54—The mists above them hasten through the skies.
 56—As if to meet some angels up there in the skies.

FIII

- F 2—To meet the sun as he mounts the skies.
 9—In frenzied gladness toward the darkened skies.
 23—And joyous songsters flit through sunlit skies.
 27—The birds awake and earth is paradise.
 43—The buds do bloom, all nature welcomes spring.
 44—And we must move, or else encounter flies.
 46—When the winds blow and the rain downward flies.

FIII interspaced

- F 15—And over all bends the encircling skies.
 18—Reaching, it seems, to paradise.
 29—The mountains smile and jocund are the skies.
 32—As slowly up the trail we wend our way.
 50—To bear on high their gladness to the skies.
 56—As if to meet some angels up there in the skies.

FIV

- F 7—The nestling first his tiny winglet tries.
 19—The birds go swimming and the alligator flies.
 26—What is the matter, do you think, with that man's eyes.
 42—And human hearts like birds seek nests and skies.
 54—The mists above them hasten through the skies.
 55—In honor of the morning sacrifice.
 57—For spring brings new life and added size.

There are no interspaced values for *FIV*.

Extras

- A 14—The land that God had promised him so fair.
 32—The burden of black dread, the weight of care.
 50—In all the gay and festive games so rare.
 57—The fun and frolic of the village fair.
- B 14—No earthly friend forgive, nor penance pay.
 15—The scars of sin, once made, forever stay.
- C 2—Oft shed their light upon the inward mind.
- D44—And all their virtues kindly magnifies.
 45—And all their little glories magnifies.
 46—Reflecting beauty where no beauty lies.
 53—And each success unduly magnifies.
- F 3—And spring once more has brought her glad surprise.
 7—The nestling first his tiny winglet tries.

TABLE I

Keys Showing the Presumably Correct Order for Each Set of Lines of Poetry, and the Quality of Some Extra Lines

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
A13	66	14	A I 10	19	A 8	81
A12	95	17	4	19	A42	112
A44	125	18	2	19	A16	144
A31	155	15	5	17.5	A60	171
A49	186	16	4	18	A28	206
A 3	217	15	10	20	A27	236
A37	251	17	6	20	A50	261
A57	275		A II			
A56	69	16	6	19	A 8	81
A47	100	19	2	20	A36	114
A 1	129	15	2	16	A 4	145
A22	160	14	3	15.5	A41	174
A25	188	18	3	19.5	A28	206
A35	220	17	6	20	A27	236
A37	251	16	7	19.5	A14	259
A32	277		A III			
A39	74	18	5	20.5	A26	90
A59	103	20	3	21.5	A21	121
A54	133	16	2	17	A 6	149
A 5	164	20	2	21	A34	178
A11	193	17	5	19.5	A40	209
A33	221	16	5	18.5	A27	236
A37	251	17	6	20		
A57	275					
1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
B 6	60	18	B I 8	22	B57	72
B41	92	19	0	19	B55	106
B28	121	19	3	20.5	B47	131
B54	150	16	2	17	B43	164
B12	180	16	3	17.5	B23	195
B 3	209	20	0	20	B24	225
B37	241				B15	255
			B II			
B 4	64	16	8	20	B27	83
B 2	96	17	3	18.5	B 8	109
B48	123	20	3	21.5	B58	143
B10	154	17	5	19.5	B22	170
B18	187	19	0	19	B40	200
B 3	209	20	0	20	B51	227
B37	241				B14	256
			B III			
B57	72	17	3	18.5	B 5	87
B55	106	15	11		B 1	117
B47	131	19	1	19.5	B54	150
B49	161	20	2	21	B12	180
B31	192	19	6	22	B17	207
B33	222	20	2	21	B46	235
B60	255					

TABLE I—Continued

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
C31	58	18	9	22.5	C57	78
C18	88	15	4	17	C25	103
C46	118	21	1	21.5	C40	134
C59	148	16	3	17.5	C27	163
C47	180	17	3	18.5	C42	193
C56	208	17	3	18.5	C 5	220
C41	236				C 2	255
C34	58	19	6	22	C57	78
C22	87	16	8	20	C 4	105
C 7	117	17	1	17.5	C54	134
C19	149	18	1	18.5	C35	162
C47	180	17	4	19	C49	193
C10	206	19	4	21	C60	219
C55	236					
B IV						
B27	83	15	8	19	B 2	96
B34	111	18	4	20	B39	128
B58	143	17	4	19	B13	158
B29	173	17	7	20.5	B18	187
B 9	202	15	5	17.5	B56	220
B46	235	17	11	22.5	B37	241
B36	262					
D I						
D12	66	20	6	23	D39	82
D43	97	15	4	17	D32	112
D 9	126	18	4	20	D33	140
D52	157	20	2	21	D21	171
D22	188	19	4	21	D48	201
D31	216	16	3	17.5	D60	231
D 6	244	21	2	22	D45	263
D44	280					
D II						
D34	72	18	3	19.5	D11	86
D19	103	16	5	18.5	D36	115
D35	132	19	3	20.5	D 1	146
D23	162	18	3	19.5	D28	175
D38	191	20	3	21.5	D 8	204
D31	216	20	4	22	D40	233
D42	252	18	7	21.5	D53	268
D46	284					

TABLE I—Continued

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
C III						
C57	78	16	6	19	C37	97
C 4	105	19	1	19.5	C15	123
C45	137	16	4	18	C38	156
C21	169	17	5	19.5	C 9	183
C13	200	19	2	20	C20	216
C53	228	15	5	17.5	C52	242
C 8	260					
E I						
E23	49	20	6	23	E15	66
E29	80	17	5	19.5	E13	93
E17	108	19	2	20	E50	125
E 8	141	17	1	17.5	E28	155
E44	173	19	4	21	E40	184
E41	200	19	2	20	E 1	214
E20	231	16	6	19	E26	245
E21	267					
E II						
E14	84	21	1	21.5	E10	104
E37	115	17	2	19	E 6	130
E12	142	19	2	20	E57	161
E44	173	19	3	20.5	E19	190
E49	206	16	4	18	E11	219
E 2	237	16	6	19	E26	245
E21	267					
1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
D III						
D37	79	18	3	19.5	D 5	92
D14	109	19	4	21	D 9	126
D33	140	17	4	19	D55	154
D27	171	17	2	18	D22	188
D48	201	15	6	18	D31	216
D57	229	20	4	22	D16	243
D45	263					
F II						
F28	74	22	0	22	F37	91
F12	109	15	4	17	F56	121
F20	134	17	4	19	F 4	149
F 5	166	19	1	19.5	F13	181
F10	195	20	1	20.5	F54	207
F27	227	15	4	17	F51	244
F45	256					
F III						
F44	82	16	4	18	F32	96
F43	109	19	0	19	F56	121
F46	137	21	2	22	F18	156
F 2	171	18	1	18.5	F15	185
F 9	204	17	2	18	F50	218
F27	227	17	5	19.5	F29	245
F23	259					

THE EFFECT OF ATTITUDE ON IMMEDIATE AND DELAYED REPRODUCTION: A CLASS EXPERIMENT

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It is well known that active recitation of matter to be memorized has a far better effect than mere passive reading or perception of it. Ebert and Meumann found, moreover, that the attitude of the learner, his "will to learn," exerts an important influence over his whole memorial result. They also found that particular adjustments of this attitude show themselves in a highly differentiated fashion. It was found, for instance, that if the reagent made it his intention to get the meaning as distinct from the words he obtained much better reproduction of the meaning, and *vice versa*. Intention to learn associates by the method of paired-associates may result in the ability to recall all the associates for which one is asked even though the complete series cannot be recited, and, conversely, when the intention is to learn the series for the recitation test one may be unable to recall each syllable when its predecessor in the series is given though one's recitation of the series is fluent and free from error.¹ These various results, shading from those of direction of the attention to specific aspects in the learning to those resulting from the more general "will to learn," are certainly, as Meumann has pointed out, of much practical importance to the student and of interest to the psychologist.

To make more real to the student the significance of this determination to learn, as well as to afford him direct introspective experience with the difference between the active and the more passive attitude, the following experiment was carried out with two groups of college students, described on a later page. As no important sex differences were noted, results are not considered on this basis. The experiment seems to have several valuable features as a class exercise.

What difference will it make in later reproduction whether a person knows or does not know while reading a list of words that

¹ For authorities on these points see WITASEK, S., *Zeitschr. f. Psychol.*, 1907, XLIV, 161-185, 246-282. EBERT, E., AND MEUMANN, E., *Archiv f. d. ges. Psychol.*, 1905, IV, 1-232. MEUMANN, E., *The Psychology of Learning*, tr. by J. W. Baird 1913, 303ff.

he will be asked to reproduce the words? This in brief was our problem, and from the nature of the case it could not be revealed until after the experiment was well on toward completion.

Two lists of common words were taken from SIMPSON, *The Correlation of Mental Abilities*, page 114, for the experiment. There were twenty words in each list, and the two lists were thought to be of approximately equal difficulty. The experiment was performed with sophomore students who were taking the second half of the course in general psychology in the university of Minnesota. When the class was assembled and the students had been provided with paper, the experimenter instructed them as follows: "I am going to write on the board a list of twenty words which each of you will kindly copy on the left margin of his sheet as I write them. Let us do this as soon as possible so that we can use the words in an experiment." As soon as the words were written the experimenter read them over once while each student checked his own list "to see that all the words were written correctly." Without any delay the students were then asked to fold over the left side of the paper so that the words could not be seen, the instructor illustrating how this was to be done. They did not yet know the purpose of the experiment. Now each was asked to write in another column near the concealed one, *in any order*, all the words of the list that he could recall. Time was not called until about a minute after all had ceased writing. The experimenter then re-read the list of words, asking each student to check carefully every word of the original list that occurred in his reproduced column, and to record the number.

The experiment was then repeated with a new list of twenty words and with this variation in procedure: the students were told that in the second case a reproduction would be called for as was done in the first, and each was encouraged to do as well as possible. To make this encouragement effective the students were informed that each one would be given his relative rank on this exercise. Conditions of time and of emphasis on the three kinds of impression—visual, auditory, and motor-tactual—were kept as nearly constant in both cases as possible.

The experiment was carried out in the manner just described in two different sections of the same course in psychology, the one section meeting at eight o'clock and the other at nine. The students of the first section were asked to be careful not to reveal

the nature or purpose of the experiment to those of the second. The details of the procedure in both of these sections were precisely alike, except that the series of words used were given in reverse order, so that the series used in the eight o'clock section "without determination," or without knowledge as to purpose, (called the passive series), was used in the nine o'clock section "with determination," or with knowledge as to purpose (*i. e.*, used as the active series). This reversal of order of the series of words used was intended to make up in a measure for the lack of standardization of the words. If one series of words should prove to be harder to reproduce than the other series this difference would presumably be noticeable by the reversal in the order just described. The two lists of words used are given on a later page in this paper.

After the experiment as just described had been carried out the papers were all collected and no intimation was made as to any further tests of the kind. It was, however, intended by the instructor to find the effect of the more active attitude on delayed reproduction. Accordingly, two days later, or precisely forty-eight hours after the first impression, the students were again asked to write down all the words of either list that they could recall.

The results of these experiments were gone over carefully from several standpoints. Two papers were excluded because of incompleteness of record and one because the student had suspected when the first series was given that a reproduction would be called for. The results of all other students are here given.

TABLE I.

Section I (The eight o'clock section)

Student	Passive List		Active List	
	Im. Rep.	Delayed Rep.	Im. Rep.	Delayed Rep.
A.....	14	9	18	12
B.....	13	9	7	3
C.....	12	5	16	14
D.....	14	5	11	9
E.....	7	2	13	11
F*	11	..	13	..
G.....	12	4	15	9
H.....	10	5	13	7
I.....	11	6	10	8
J.....	13	4	14	8
K.....	9	10	10	8
L.....	9	5	15	6
Totals.....	135	64	155	95
Av.....	11.25	5.82	12.92	8.63
A. D.....	1.75	1.95	2.28	2.14

* F was absent at the time of the delayed reproduction.

TABLE II.

Section II (The nine o'clock section)

A.....	9	3	9	6
B.....	6	4	10	8
C.....	9	11	13	8
D.....	15	8	14	9
E.....	6	6	14	12
F.....	10	7	18	15
G.....	16	5	13	7
H.....	12	13	16	14
I.....	12	8	15	13
J.....	9	6	14	16
K.....	9	6	15	10
L.....	9	6	14	13
M.....	11	6	13	10
N.....	9	8	14	13
O.....	13	7	15	12
P.....	13	7	17	12
Q.....	12	7	13	11
R.....	9	12	15	16
S.....	6	2	6	4
T.....	13	6	13	8
U.....	9	3	13	6
V.....	11	9	15	12
W.....	10	6	15	8
X.....	10	3	12	5
Y.....	6	6	11	8
Z.....	12	9	13	14
AA.....	9	7	8	10
BB.....	12	5	15	14
CC.....	9	10	12	12
Totals.....	296	196	385	296
Av.....	10.21	6.77	13.27	10.21
A. D.....	2.04	1.93	1.85	2.80

From these tables it will be noted that in Section I 75% of the students made a better record with than without determination in immediate reproduction, and 82% of the students made a better record with determination in the delayed reproduction. In Section II the corresponding percentages are 83 and 97, respectively. Comparing the total words reproduced by each of the two sections we find that

In Section I²

Immed. Reprod. with determination was 14.8% better than without deter.

Delayed Reprod. with determination was 48.4% better than without deter.

In Section II

Immed. Reprod. with determination was 30.0% better than without deter.

Delayed Reprod. with determination was 51.0% better than without deter.

It is important to note that the gain in delayed reproduction—the delay period it will be remembered was 48 hours—is considerably greater than in immediate reproduction, being about 50% as against 14% to 30%. It is well known that unassociated content, such as nonsense syllables, fades from the mind more rapidly at first than meaningful or associated material. It is natural therefore to expect a greater gain with the active attitude, as we actually obtained, in the delayed reproduction than in the immediate reproduction. This greater gain with delayed reproduction would seem to give us a valuable suggestion as to just what the difference is in the two attitudes studied in this

² When the "probable errors" of the average number of words reproduced per student are taken into account, which procedure is advisable because of the small number of subjects tested, these results will stand as follows:

In Section I

Immed. Reprod. with deter. is 6 to 25% better than without deter.

Delayed Reprod. with deter. is 28 to 73% better than without deter.

In Section II

Immed. Reprod. with deter. is 23 to 37% better than without deter.

Delayed Reprod. with deter. is 38 to 65% better than without deter.

It is, of course, evident that the results from the smaller section (Section I) are more variable, therefore, less reliable, than those from the larger section. The gain due to the active attitude is obviously considerable. The probable errors for this calculation were derived from the average deviations, given in the text, by the formula

$$P. E. M = \frac{0.8453}{\sqrt{n-1}} A. D.$$

paper. It would seem that the active attitude (with determination) differs from the passive in other and more important respects than in merely making the stimulus more intense. There is evidence also of better association in the active attitude.

This evidence is corroborated by the introspective reports of the students. Each student was asked as soon as the immediate reproductions had been completed to write out a careful statement of any differences that he had noted or could recall between the methods of his "receiving," or being impressed by, the so-called active and passive series of words, respectively. In the case of the active list of words some of the students report that they went faster and repeated words, but generally the introspections abound with evidences of association in various ingenious ways. I give the chief types: "I tried to keep in mind words that occurred together"; "tried to associate each word with something, e. g., *light* with our new light at home, *late* with returning home late"; "made sentences out of some of the words, and associated others"; "associated *tall* with *friend*, also the first letters of several of the words"; "I connected *big*, *tall*, *thin*, *empty*, etc."; "associated words of similar endings, as *rich*, *sick*"; "associated words similar in meaning, as *good*, *glad*, *happy*"; "was more alert and associated the words"; "tried to connect words with something, as *empty* chair, *false* prophet, etc."; "tried to memorize them (!) while in the passive list there was no such motive." And so on. The other section found their "active" list no less susceptible of associations. For instance, "associated *stale*, *dirty*, *hot*, *heavy*, *sour*."

The students were of course not experienced in introspection. Interesting evidence of a wholly objective kind was fully as illuminating as the introspections, and frequently gave certain evidence of associations not noted in the introspections at all. This type consisted of the occurrence in the reproductions of words not among the stimulus words (see lists below), and also of various methods of grouping the reproduced words, i. e., of the various orders in which the words were recalled. Some students gave the order backwards to a considerable extent, others gave the words nearly in their original order, while still others grouped them significantly, as their introspections would lead one to expect. A careful study of the groupings of various words recalled in delayed reproduction would doubtless reveal not a little

of the contents of the subjects' mind even though wilful rearrangements could not so easily be prevented as in certain experiments in association.

Another means of getting at the associations effective in our present exercise is afforded by the frequency of occurrence in the total reproductions of each of the stimulus words. Each paper was gone over very carefully and tallies were made of the frequency of reproduction of each word. The results are contained in the following tables. These tables consist of each of the stimulus lists, both the active and the passive as given to each section, and also of the frequency of occurrence of each word in the reproductions in both the passive and active list of each section. These frequencies may be used for the double purpose of throwing light on the relative effectiveness of the secondary laws of association—frequency, recency, primacy, and vividness—and also of affording a means of determining whether the individual words and the two lists of words were of approximately equal difficulty. It will be remembered that the two lists were reversed in order for the two sections, so that the active list for Section I became the passive list for Section II. In Table III, P and A, after the section numbers, stand for active list and passive list, respectively. I. R. is for immediate reproduction, D. R. for delayed reproduction. The figures under these letters give the number of persons, or the total number of times possible for any word to occur. The totals of the columns here must, of course, equal the totals of the corresponding columns in the other tables, I and II.

TABLE III.

Stim. Words X	Sec. I, P. Freq. in		Sec. II, A. Freq. in		Stim. Words Y	Sec. I, A. Freq. in		Sec. II, P. Freq. in	
	I. R.	D. R.	I. R.	D. R.		I. R.	D. R.	I. R.	D. R.
	12 O's	11 O's	29 O's	29 O's		12 O's	11 O's	29 O's	29 O's
good	9	4	24	13	stale	11	8	26	12
outside	6	3	25	13	hot	10	7	19	7
quick	5	2	20	8	dirty	9	4	20	11
tall	11	3	22	18	heavy	8	3	5	4
big	6	2	20	18	late	10	7	17	13
loud	5	1	11	8	first	4	3	8	5
white	5	4	16	24	left	5	2	5	1
light	8	6	19	24	morning	10	7	15	12
happy	7	5	17	17	much	4	1	9	5
false	11	4	14	7	near	4	1	10	7
like	7	5	13	12	north	11	8	21	21
rich	7	3	20	23	open	6	6	13	7
sick	10	3	22	21	in	11	8	28	28
glad	3	4	13	13	sharp	4	2	10	6
thin	6	1	18	8	east	9	7	18	18
empty	4	1	17	10	sour	9	2	17	8
war	8	6	24	21	something	7	7	14	9
many	8	1	24	15	stay	6	3	10	4
above	1	1	18	7	push	5	3	11	4
friend	8	6	28	16	nowhere	12	6	20	14
Totals	135	64	385	296	Totals	155	95	296	196
Av.	6.8	3.2	19.5	14.8	Av.	7.8	4.8	14.8	9.8

Among the reproductions were found the following words, a number of which reveal clearly trends of associations present in the subjects' minds during the impression and reproduction: *shut, last, far, party, time, new, west, with, early, rather, somewhere, window, south, here, nothing, stage, bright, take, place, black, life, short, duty, cold, bread, haste, and far.*

It seems likely that the two sets of stimulus words, X and Y, are not seriously unequal in difficulty of reproductions. The X series seems to be slightly easier, if there is any real difference. It is very difficult to get a homogeneous group of meaningful words. Table III shows that some of the words actually used were comparatively easy to recall while others were hard. These differences, however, are about equally distributed in the two series, X and Y. It is not easy to understand why such words as *above, empty, much, near, and heavy* should be so much harder to reproduce than *in*. Words relating to direction, and to certain frequent and important experiences, such as *late* (we had frequently emphasized in the class the necessity of being on time), *sick, war*, were retained well. *Light* and *white* were usually asso-

ciated together as was evident from the fact that they were usually both reproduced together or both omitted. This of course greatly increased the probability of the recall of each of the two words. This is unquestionably true also of other groups of words in the lists. Because of these conditions, producing a lack of homogeneity in the stimulus words, it is not safe to attribute much influence to primacy and recency, even though the first and the last words in each series were recalled with more than normal frequency.

In a somewhat similar study by Miss Mulhall, on the effect of determination on recall and recognition,³ in which syllables, forms, words, and photographs and names were used, it was found that the effect of determination on recognition was very small in comparison with the effect of determination on recall; but as the methods were not alike in the two experiments it is impossible to compare our results quantitatively with hers. She found the difference between the effect of determination on recall and on recognition greatest on pictures, greater on forms than on words, and greater on words than on syllables. These results would seem to suggest, as do ours, that the "will to learn" shows itself most effectively in material affording easy and numerous associations.

What, then, is the nature of this determination or "will to learn?" Does the difference between this state of mind and the more passive attitude consist mainly in making the impression more vivid, or intense, by greater clearness of attention? This seems improbable from the results. Will is now regarded by psychologists, as a rule, not as a mysterious adding to the dynamic force of the individual, but rather as a complex result of various stimuli acting both directly and indirectly upon a mechanism which is partly inherited and partly acquired. That is to say, will is conditioned by circumstances. The additional stimulus in our experiment that brought about the will to learn was the statement to the students before giving the active list of words that they would be asked to reproduce the words. This statement, operating by association through various neural dispositions, produced a much more definite response attitude than was possible in connection with the passive list, and thereby made

³ MULHALL, EDITH F., "*Experimental Studies in Recall and Recognition*," *Amer. Jour. Psychol.*, 1915, XXVI, 217-228.

possible certain definite associations. Whether this is the same thing as saying that the attention was more concentrated on the words in the active list is a question. Intensity of stimulation, moreover, may mean any of several things. Too frequently it is taken to mean merely the physical intensity. It also and particularly means, with respect to behavior, that the stimulus is closely connected with response dispositions. From this point of view only was the stimulation greater in the list of words given with determination to learn. It seems to be true that the will to learn is not very effective if one is permitted merely to observe as actively as possible the series of words presented, but not to associate them;⁴ but this is merely putting a restriction on one's readiness for response. It must be admitted that we are not yet in a position to say in just what this will to learn consists, either psychically or neurally. It appears that the active attitude brings into coöperation a number of factors, though just how this is brought about is one of the many questions in psychology which we shall be a long time in answering.

⁴ MULLER AND SCHUMANN, cited by LADD AND WOODWORTH, *Elements of Physiological Psychology*, p. 582.

A STUDY OF MENTAL FATIGUE WITH A GROUP OF FIVE BOYS

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NATURE AND AIM OF THE EXPERIMENTATION

This study of mental fatigue consists of an examination of five boys about thirteen years of age. The following tests were given:

1. The first test consisted of a one-digit continuous addition test lasting two hours, the aim being to secure the work curve and the degree of sustained attention and degree of fatigue that would appear in the case of a child. Kraepelin's additions as arranged by Stoelting and Company were used (Whipple, "Manual of Mental and Physical Tests," vol. II, 97).

2. The addition test was preceded and followed by a discrimination of grays test. This test was inserted as an experiment on a suggestion made by Meumann a few years ago that other sensory fields besides the cutaneous (*i. e.* the aesthesiometer tests) might offer less mechanical difficulty, and be less at the mercy of suggestion, and demand just as high a degree of discrimination, and consequently make a better fatigue test. The material for the test consists of a color mixer with black and white disks. When rotating the disks produce the following effect upon the eye; first an outer circular band of gray, then an inch circular strip of white, and finally a circle of gray in the center. The outer circle of gray constituted the norm of comparison, on the inner circle could be secured minimal changes in gray. The unit of variations was 5 degrees of black, varying from 130 degrees of black to 210 degrees. The usual precautions of neutral background, uniform conditions of light, etc., were taken.

3. The third test consisted of mental multiplication (a three-place by a one-place number), and simultaneous mental addition. The work lasted two hours. The aim was to secure as nearly as possible a purely mental work, and to contrast the efficiency in the first and second hour. The first addition problem started with 7 and 6, alternately adding 2 to the 7's column and 3 to the 6's column. The second addition problem started with 5 and 9,

adding respectively 3 and 2 (Whipple, "Manual of Mental and Physical Tests," vol. I, 338).

4. Before and after the test just mentioned Scheiner's experiment of the accommodation of the eye was given. The enthusiasm of Dr. A. Baur over this test of mental fatigue led to its use in this study. (Sanford, "Experimental Psychology," 90. Titchener, "Instructor's Manual, Qualitative," 236 ff. Inter. Mag. of S. Hygiene, VII, 52-92. Baur, "Die Ermüdung im Spiegel des Auges.") As test three practically eliminated eye strain, this seemed an excellent place to study correlation between accommodation and a purely mental situation.

Preliminary drill was given until each test was thoroughly familiar to each subject.

GENERAL CONDITION OF EXPERIMENTATION

The five boys selected for the tests were normal in every respect, perhaps a little superior in intelligence but not precocious. They tested above normal with the Binet tests, but home conditions were in every case above average. The aim was to get normal and dependable workers. Physical tests revealed no eye or ear defects, while the general health was good in every case. The boys ranged in age as follows; H-T, 13 yrs., 8 mo., H-D, 13 yrs., A-K, 13 yrs., E-H, 12 yrs., 8 mo., A-J, 12 yrs., 2 mo. The testing and preliminary practice were always individual, and sometimes during the forenoon. The set work periods of two hours were always on holidays, and from 8 to 10 A. M. Drill to eliminate practice effects and to secure uniform response preceded the final use of the tests in the work curves. Preliminary practice also preceded the use of the discrimination of grays test and the Scheiner experiment.

Care was taken to avoid suggestion and to provide incentive. When the boys were asked to act as subjects they were told that business men constantly complained that the schools did not teach the students to do arithmetic quickly and accurately. The experimenter told them that after a little drill he planned to have them work at addition and multiplication and he hoped their records would show that they could work accurately and rapidly for a long time. *No suggestion was given concerning fatigue.* To secure the best possible response the boys were paid twenty-five cents an hour, and the implication was that they were to conduct them-

selves as any paid clerks. When marked variations appeared in the work curve questions were asked to ascertain if a local cause could be found. The complete elimination of suggestion seems of primary importance combined with a favorable emotional attitude.

ADDITION TEST

Method of procedure. In the addition test the subject was given the following instructions:

1. Add aloud as fast as you can, but try not to make any mistakes.
2. Add each number separately and in turn to your partial sum.
3. *As soon as a mistake is made I will call, "No," and give you the correct partial sum at that point.*
4. Do not repeat the first digit in beginning a new addition. The object in correcting the error in addition was two-fold; first, to aid the experimenter in scoring mistakes, and second, to hold the subject to a high standard of accuracy by making him aware of his mistakes *at the time of their occurrence*. A new addition was begun every ten digits. There was no intermission during the addition period except a pause for a sip of water, to change position, and to take introspection in rare cases. The total period during which addition was carried on was thus a little over two hours.

In the discrimination of grays test the subject was asked to state his judgment as follows: (1) the inner gray is lighter than the outer, (2) the inner gray is darker than the outer, (3) the grays are equal.

Results from the Addition Test. Continuous oral addition is primarily concerned with mental processes, but fatigue of throat and eye are both theoretically possible. However, neither voluntary introspections, nor direct questions at the close of the two-hour period elicited any complaint of eye strain. (The activity of the external muscles of the eye would, of course, be much less than for an equal period spent in reading.) All of the subjects, however, complained of some difficulty from the continuous speaking. This however was not noticeable until after the first hour's work. H-T who added very rapidly became somewhat husky at the last. In his case, the sudden low score after forty-five minutes work was accompanied by a request for a drink.

With all the subjects it is safe to say a general decrease in rate is partially due to this cause.

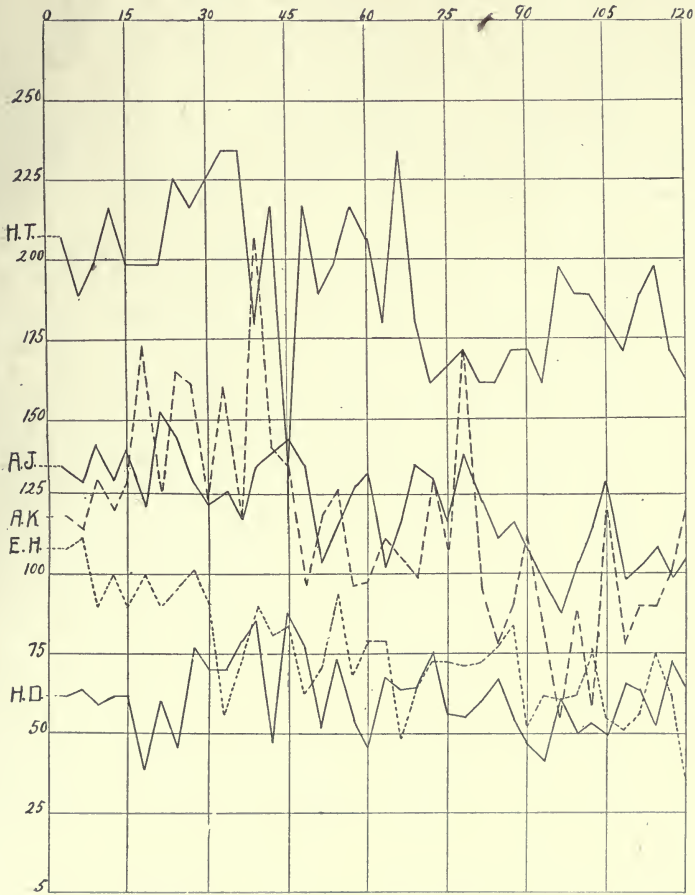
1. A study of the curves (Tab. I, Graph I) will show that no appreciable decrease below the initial speed occurred during the first hour's work, with the exception of E-H. In the second hour's work, the quantity is considerably less with the exception of H-D, whose rate is the lowest, and also the most uniform.

Subject	1 Percental decrease in quantity during second hour	2 Percentage of errors during first hour	3 Percentage of errors during second hour
H-T.....	10.3	.8	.8
H-D.....	6.7	6.7	5.5
A-K.....	24.9	3.1	4.4
E-H.....	15.6	7.2	8.8
A-J.....	14.7	2.5	2.8

2. Many studies of fatigue indicate an increase in speed and a decrease in accuracy as the work prolonged. A comparison of columns 2 and 3 in the preceding tabulation shows that the quality remained fairly constant. Of course, *the checking of every mistake at the time of its occurrence tended to check a progressive drift into inaccuracy.* While the total number of errors for all the subjects was greater during the second hour, with three of the five a larger number of mistakes was made during the first hour. However, totals considered in terms of percental decrease based on the total quantity score yield but a small per cent. A decrease in accuracy is not demonstrated. When one considers that the work was far more strenuous than an equal time spent in school work, in its monotony, enforced sedentary conditions, length, and the throat strain involved, the decrease in quantity is not great.

It is interesting that the two boys who made the lowest percental decrease in the quantity score the second hour also had as few or fewer errors the second hour. In fact, H-D had a better accuracy score the second hour, but it must also be noted that his rate was the lowest of any of the boys and his absolute number of errors the greatest of any of the boys during the first hour, with the exception of E-H.

An examination of the distribution of errors (Tabulation I) does not indicate that there is any *progressive trend*. Often five or ten errors are recorded for a period of three minutes. Turning to the



GRAPH I

Continuous One-place Additions
 Horizontal numbers = minutes
 Vertical numbers = additions

TABULATION I. CONTINUOUS ONE-PLACE ADDITIONS

First Hour											Second Hour											
Each No. Indicates a Period of 3 Min.	H. T.		H. D.		A. K.		E. H.		A. J.		Each No. Indicates a Period of 3 Min.	H. T.		H. D.		A. K.		E. H.		A. J.		
	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions		Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	
1	1	207	3	62	4	117	3	108	5	135	21	2	180	3	67	3	111	2	79	3	103	
2	2	189	1	64	3	113	61	11	4	128	22	2	234	6	64	5	105	10	48	2	117	
3	2	198	6	59	3	130	5	90	1	141	23	2	180	3	65	3	99	5	65	2	135	
4	0	216	5	62	4	120	4	99	2	129	24	3	162	2	75	3	131	6	72	1	131	
5	3	198	2	62	5	130	4	90	3	140	25	3	171	3	56	5	108	4	72	3	117	
6	2	198	3	38	1	174	5	99	4	121	26	1	171	2	55	2	172	4	71	0	138	
7	2	198	4	60	2	126	2	90	2	153	27	2	162	2	60	6	96	7	72	4	122	
8	2	225	5	45	3	165	11	95	2	144	28	1	162	2	67	6	77	6	77	3	112	
9	1	216	4	76	2	161	6	101	2	130	29	1	171	3	54	4	91	3	84	4	117	
10	2	225	4	70	5	124	4	92	4	122	30	2	171	5	47	5	112	6	53	2	108	
11	2	234	3	70	5	160	10	56	5	126	31	1	162	4	41	5	82	8	62	7	96	
12	1	234	2	79	5	119	5	72	5	117	32	0	198	6	61	4	55	5	61	5	84	
13	2	180	5	86	3	207	4	90	4	135	33	2	189	3	50	5	98	4	62	6	104	
14	1	216	8	47	1	141	4	81	3	140	34	1	189	1	53	5	59	2	76	1	115	
15	1	135	5	88	5	135	5	94	3	143	35	1	180	3	50	6	120	6	55	1	130	
16	0	216	4	77	6	96	10	63	4	135	36	1	171	1	66	3	78	5	51	3	98	
17	3	189	3	53	5	119	7	70	4	104	37	2	189	4	64	4	90	8	56	3	102	
18	1	198	5	73	7	126	5	94	3	126	38	1	198	4	53	4	90	4	75	2	108	
19	3	216	5	54	5	96	4	67	3	126	39	1	171	3	73	6	101	6	63	7	99	
20	3	207	8	46	7	97	7	79	2	132	40	2	162	5	65	4	120	10	36	3	105	
	34	409	5	85	1271	82	2656	111	1741	65	2627		29	3573	65	1186	88	1995	114	1290	62	2241

NOTE—Second hour's work was a continuation of first hour's—put in separate tabulation for purposes of contrast.

introspections and attitude of the subject, there is an indication of embarrassment and confusion arising out of the consciousness that errors were being made in quick succession. This condition seemed to be especially true of A-K, who would blush, stammer and make nervous haste at such times. Apropos to the discussion of errors and the emotional factors involved, H-T should be considered. He was by far the most rapid and most accurate of any of the subjects. Also his *ideal of accuracy was high*. While his groups of continuous errors are always short, the emotional element is pronounced. A study of his graph shows that there is a correlation between reduction in speed and reduction in accuracy. His attitude and introspections would both indicate that emotional element played an important part.

While it is perhaps true that fluctuation of attention helped to initiate a group of errors, it is also most certainly true that an unfavorable emotional element tended to prolong the group. Embarrassment, chagrin, vexation, a psychological hoodoo—the suggestion “now I have started to make mistakes I’ll make them,” all tended to decrease the efficiency when once inaugurated, yet they are not factors of fatigue proper.

No attempt has been made to reduce quantity and quality to a common score. While they are related they do not have a common denominator and any attempt to reduce to a single value must be an arbitrary matter.

3. The question of speed. The directions were, “Add as fast as you can but try not to make mistakes.” However, the speed was not so great as in some of the preliminary drills in the case of H-D and possibly with some of the other subjects. There seemed to be an unconscious adjustment to a judicious speed compatible with prolonged effort, somewhat similar to the attitude and adjustment for the 100-yard dash or the mile. This adjustment appeared again in the multiplication, a situation similar to that in Arai’s experimentation. The question should be raised in long periods of work whether there is not just such an adjustment, unconscious to be sure, but nevertheless concealing a decrease in speed that would have been evident had the initial speed been absolutely the maximum. Practice effects would also tend to be reduced.

4. Summary. The two-hour work period in addition does not indicate any marked or uniform reduction in accuracy. There is a progressive reduction in quantity after the first hour. The appearance of this reduction *after* the first hour’s work, with the exception of E-H, combined with a sustained accuracy, would seem to indicate that the average work period in the school with the constant change and variety is not a mental tax to the average student. Introspection and the attitude of the students indicate that throat fatigue was more prominent by far than an unpleasant mental condition.

DISCRIMINATION OF GRAYS (TABULATION II)

The results are neutral. While the total number of mistakes was greater than before the additions, three of the boys showed more errors *before* than *after*. A comparison of the differences

before and after shows about the same fluctuation in the individual response that was found in the trials from day to day, where the factor of fatigue was not involved.

TABULATION II
Discrimination of Grays

Degrees	H. T.		H. D.		A. K.		E. H.		A. J.	
150*	l	l	l	l	l	=?l	l	d	=	l
180*	=	=	d	d	d	d	d	=	ld	=
210.	d	d	d	d	d	d	d	vd	d	d
205.	d	d	d	d	d	d	d	vd	d	d
200.	d	d	d	d	d	d	d	vd	d	d
195.	d	=	d	d	d	d	d	vd	d	d
190.	=	=	d	d	d	=	d	d	=	ld
185.	=	=	d	d	d	=	d	ld	=	=
180.	=	=	d	=	=	=	ld	ld?	=	=
175.	l	l	d	=	=	=	=	=	ll	=
170.	=	l	=	l	=	=	=	=	ll	l
165.	l	l	=	l	l	=	=	=	ll	=
160.	l	l	l	l	l	=	=	=	ll	=
155.	l	l	l	l	l	l	=	l	ll	=
150.	l	l	l	l	l	l	l	l	ll	=

l = lighter

ll = a little lighter

d = darker

ld = little darker

v = very

Tabulation of Errors

Subject	Before	After	Last drill
H-T.....	2	6	3
H-D.....	6	5	5
A-K.....	4	3	3
E-H.....	2	5	2
A-J.....	4	1	4

MULTIPLICATION, ADDITION AND SCHEINER'S EXPERIMENT

Method of Procedure. The tests were arranged in the following order:

1. Scheiner-Baur accommodation of the eye test.
2. $\frac{3}{4}$ hr. of multiplication.
3. $\frac{1}{4}$ hr. of simultaneous addition.
4. $\frac{3}{4}$ hr. of multiplication.
5. $\frac{1}{4}$ hr. of addition.
6. Repetition of Scheiner-Baur test.

The time indicated is the net time of the actual mental work, exclusive of instructions, slight interruptions, etc. In the multi-

*Preliminary test.

plication test the problem was placed on a slip of paper. The following instructions were given: "Get the problem in mind, place the slip face downward, close your eyes if you desire to and multiply as fast as you can without making mistakes." In the addition test the subject had been taught to take the addition verbally as follows: "Start with 7 and 6, add 2 to the 7 and 3 to the 6. Ready. Add." Or in the second case, "Start with 5 and 9, add 3 to the 5 and 2 to the 9. Ready. Add." When an error occurred, the experimenter stopped the subject with "No," and supplied the correct partial sum or sums. This seemed desirable to avoid a careless lapse as regards accuracy, and also there was the tendency to make errors which reduced the difficulty of the addition after the initial error: *e. g.*, 62—42, or 63—67, for 62—47. In the preliminary practice it became evident that there was a common tendency to reduce the partial sums to an identity either in the units or else in the tens. In some cases one or both of the partial sums were lost by the subject. Such cases were scored as errors. In scoring the multiplications account was kept of the total number of digits in all the products. An error was scored for each incorrect digit.

TABULATION III

Multiplication

Name	First $\frac{3}{4}$ Hour			Second $\frac{3}{4}$ Hour		
	Total No. of Figures	Errors	Percent. of Errors	Total No. of Figures	Errors	Percent. of Errors
H. T.....	239	34	13.2	320	56	17.5
H. D.....	139	24	17.3	136	24	17.6
A. K.....	119	30	25.2	120	40	33.3
E. H.....	151	61	40.4	228	101	44.3
A. J.....	199	31	15.6	304	33	10.9

Simultaneous Addition

Name	First $\frac{1}{4}$ Hour			Second $\frac{1}{4}$ Hour		
	Total No. of Figures	Errors	Percent. of Errors	Total No. of Figures	Errors	Percent. of Errors
H. T.....	320	20	6.3	312	31	9.9
H. D.....	180	31	17.2	170	24	14.1
A. K.....	154	27	17.5	178	23	12.9
E. H.....	236	32	13.6	186	43	23.1
A. J.....	214	29	13.6	198	32	16.2

RESULTS IN THE MULTIPLICATION TEST (TABULATION III)

1. There was an absolute increase in the number of errors during the second period of multiplication in every case except one, H-D. There was also a percental increase with the exception of A-J.

2. As stated in connection with the one-place additions any attempt to reduce quality and quantity to a common denominator is an arbitrary matter. However to simplify the situation a comparison of the *correct* number of figures in the first and in the second period is given.

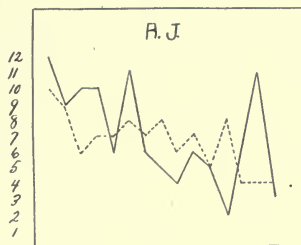
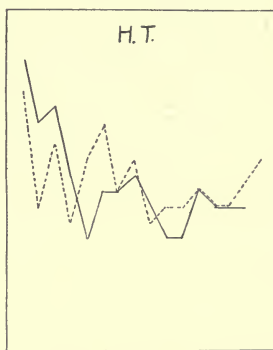
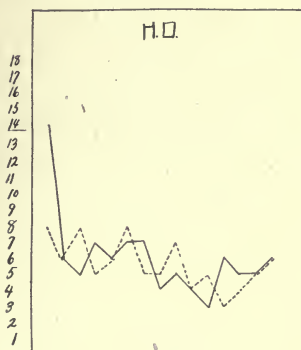
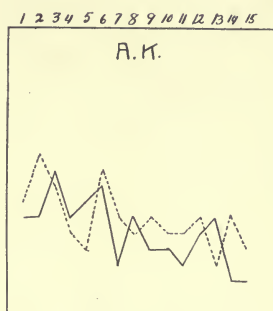
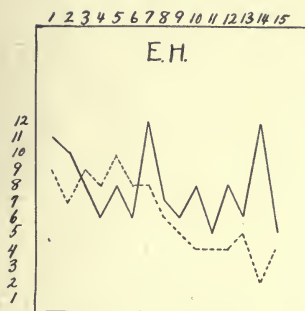
Subject	First period Quality- Quantity score Total number correct figures	Second period Quality- Quantity score Total number correct figures	Percental gain or loss in the second period
H-T.....	205	264	plus 29%
H-D.....	115	112	minus 3%
A-K.....	89	80	minus 10%
E-H.....	90	127	plus 41%
A-J.....	168	271	plus 61%

It will be noted that three of the five boys made a higher absolute score of correct figures in the second period. While there was an increase in rapidity during the second period of work, the absolute increase in correct report forbids saying there was an increase in speed at the expense of accuracy. In two cases, H-T and E-H, there was an absolute increase in inaccuracies during the second period: here nevertheless there was also an absolute increase in the second period in the correct number of figures. There was no trend towards increased inaccuracy during the second period.

3. A contrast of the first period of work with the second period of work makes it very difficult to say that there was any *constant trend* in the factors in the second period which would warrant a generalization concerning fatigue. In view of the monotonous character of the multiplication, and the length of the work period compared with the schoolroom, there seems little warrant from a study of the mental output for the belief that appreciable fatigue is present in the ordinary work period of the school-room.

RESULTS IN ADDITION (TABULATION III GRAPH II)

1. With three of the five subjects there was an absolute increase in errors during the second period of addition. In one case the



GRAPH - II

Comparison of
Simultaneous Addition Curves

Abscissa = minutes of time
Each ordinate no = two additions
Solid line = first work period; dotted = second

increase was slight, A-J. As errors were corrected at the time of their occurrence there was probably a tendency to reduce both the number of errors and the speed. In three of the five cases there was a percental increase in the errors made. Subtracting one from the total addition score for each error made, we have the following qualitative-quantitative score.

Subject	First period Number cor- rect figures	Second period Number cor- rect figures	Percental loss or gain
H-T.....	300	281	minus 7%
H-D.....	149	146	minus 2%
A-K.....	127	155	plus 23%
E-H.....	204	143	minus 30%
A-J.....	185	166	minus 10%

In the absolute number of additions and in the absolute number of correct additions the first period of work surpassed the second period of work with the exception of A-K. In two cases the percental decrease in the second period is slight. In the case of E-H the percental and absolute decrease was marked as elsewhere with the exception of the multiplication tests where there was no check on accuracy, and in this case there was an enormous percentage of errors, in the first half of the experimentation 40.4% and in the second half 44.3%.

Judging from the tests given it would seem that the simultaneous addition tests give the most uniform symptoms of fatigue. The addition demands a sustained continuity of attention, memory span, and an exact constructive process in association. To the writer, however, such results are not at all conclusive that mental fatigue is present. The artificial nature of the problem, the lack of any strong incentive, the monotony of the situation, all could be factors in decrease in efficiency as well as fatigue.

RESULTS OF THE SCHEINER EXPERIMENT (TABULATION IV)

It will be kept in mind that the nature of the addition and multiplication reduced the eye strain to practically nothing. Any effect on the ciliary muscle would then have to be either part of a general decrease in muscular efficiency, or a decrease in some mental factor as attention. The supposition would seem to be that the accommodation of the eye involving a peculiarly delicate muscular adjustment would be more easily effected, while in the nature of the case the fluctuation in the near-point of vision would offer an excellent *degree* score.

TABULATION IV.

Scheiner's Experiment

Right Eye

No.	H. T.		H. D.		A. K.		E. H.		A. J.	
	B	A	B	A	B	A	B	A	B	A
1	14.5	15	12	11	16	14.1	9.7	12.4	9.2	10.1
2	15	14	9.1	10.1	15.8	17.3	12.2	13.1	10.7	10.4
3	16.5	13	13.3	12.3	17.2	18.2	11.8	10.8	8.2	8
4	12.2	14.5	9.5	9.2	17.4	18.5	14	11	7.9	8.9
5	14.5	15.3	12.5	12	14.1	15.8	12.8	11.3	11.1	8.1
Ave.	14.5	14.3	11.3	10.9	16.1	16.8	12.1	11.7	9.4	9.1
	*1st	†Total	1st	Total	1st	Total	1st	Total	1st	Total
	19.3	14.8	12	11.5	17.5	16	13.8	13.5	20.7	10.1

Left Eye

No.	H. T.		H. D.		A. K.		E. H.		A. J.	
	B	A	B	A	B	A	B	A	B	A
1	15	16	10	10.8	17	15.5	13.5	11.4	8.7	9.5
2	15	13	13.4	14.1	17.1	16.3	12.6	11.5	9.7	10.4
3	12	14.5	13.5	13.1	16.4	16	12.5	14.1	9.9	8.3
4	12.5	14.5	14	12.3	15.3	18	12.4	14	10.5	11.2
5	14	12	9.3	12.1	16.6	14.2	13.9	12.6	8.1	8.9
Ave.	13.7	14	12	12.5	16.5	16	13	12.7	9.4	9.7
	1st	†Total	1st	Total	1st	Total	1st	Total	1st	Total
	15.1	14	14.5	13.1	16.9	16.5	14.5	14.1	10.3	9.8

NOTE—

B = Before two hours addition and multiplication.

A = After two hours addition and multiplication.

* 1st = First preliminary test.

† Total = Average of all the preliminary trials.

The results are given in Tabulation IV. The averages do not indicate any constant difference or any particular trend. In fact they are without significance as far as fatigue goes. In any case, a comparison of the average when used as a fatigue test with the average for all the preliminary tests and the first preliminary test will show that there is about the same fluctuation in every trial. In the school situation, the local sensory fatigue of the eye is evidently the cause of the marked difference in the variation of the near-point of vision noted by Baur. Furthermore, the fluctuations in the preliminary tests indicate that it is doubtful if a norm even for rough practical purposes could be established where a large number of children are to be tested but once.

COMMUNICATIONS AND DISCUSSIONS

SOME CORRELATIONS BETWEEN LEARNING AND RECALL

In a study of Confusion (unpublished) the writer tested individually 50 normal school girls. Each was told to study a given group of words and figures so that she could reproduce them in exact order and that she would be given all the time she wanted both for learning and for recall: Time was recorded with a stop watch for both procedures.

The average learning time was 509.2 sec.; median, 473 sec.; M. V. from median, 14.92. For the recall time the corresponding figures are 174.3, 133 and 8.50. The highest learning time was 1058 sec.; lowest, 105 sec. For recall they were 463 sec. and 54 sec. respectively. The distribution for both "times" show wide variations toward the upper limit. The upper quartile for learning time was 672 sec., the lower quartile 383 sec. The respective quartiles for recall were 268 and 90.

The correlation between the learning time and recall time was $-.380$ (P. E. .0816). This negative correlation indicates that when the learning time was high the recall time was low and vice versa. It probably means that the individual who took plenty of time in making certain her learning was more certain in her reproduction.

Since the task was perfect reproduction no fair coefficient of correlation between amount recalled with learning time or with recall time could be determined. However, 27 cases had from one to 6 points wrong, with an average of 3 points in omissions and displacement. The average learning and average recall times in seconds for perfect reproduction and imperfect reproduction are given below:

<i>Learning Time</i>			
Perfect reproduction		Imperfect reproduction	
Av. 531.2	Med. 492	Av. 490.1	Med. 438
<i>Recall Time</i>			
Av. 122.7	Med. 90	Av. 219.6	Med. 224

These figures indicate that the learning time for perfect reproduction was higher, as a rule, than for imperfect reproduction while the time for perfect recall was decidedly less than for imperfect recall.

Some individuals, however, with perfect recall had very high recall-time while others with imperfect recall had very low recall-time. One-third of those with perfect recall had both recall and learning time below the respective medians of the entire group. The two subjects with the highest learning time had imperfect reproduction. Of these the recall time of one was above the median and one below. The two with the highest recall time had the lowest two reproduction times. The variations in the learning and recall times are each dependent upon some factors which the figures fail to show, such as the desire not to seem too slow in both processes; the tendency of some to be over-certain of their having learned the list; and the variations in persistency at trying to recall what at first seems to have been forgotten.

The recall time is especially indefinite as some individuals wrote their total recall at once while others after writing a part of their recall would pause struggling for a word or two. Sometimes there would be a struggle of a minute or more before giving up the task, with no additions. The recall time was computed till the subject wholly gave up the task.

In another study¹ on 84 college and university students the writer found "practically no correlation of time used in recalling the words with accuracy of recall" (coefficient $-.09$).

Bigham³ concluded that the longer the interval after learning the longer the time for recall, that the number of errors increased with the time used for recall and that "the quicker the memory is discharged the better is the result." He presented very little evidence in support of these conclusions, however. Myers² reported similar observations: "—— that the subjects who used the least time in reproducing the group of letters—remembered the most correct words and added fewer wrong ones; however, there seemed to be no way of indicating satisfactorily the correlation in terms of figures, from the fact that often a few seconds passed before the subject could think of anything."

This problem merits further study.

G. C. MYERS.

Brooklyn Training School for Teachers.

¹ MYERS, G. C. *A Study in Incidental Memory*. Arch. of Psych. 26: 1913, 65-67.

² Ibid, p. 93.

³ BIGHAM, J. *Memory*. Psychol. Rev. 1894, 1, 34-38, 453-461.

THE ANCESTORS OF EMINENT MEN¹

It has been said frequently that each man is the product of his environment. In a measure that is true, but no environment will make a Shakespeare out of an ordinary man. A great man is born, which means that he is the product of a particular kind of breeding. Similarly, a feeble-minded man is born, which also means that he is the product of a particular kind of breeding. The kinds of breeding which produce our great men and our feeble-minded men are as widely separated as are the men themselves. I cannot, in the time at my disposal, go into all of the intricacies by which different kinds of men are produced by breeding, but I can give some of the main essentials, and from these you can obtain a fairly clear understanding of what it is that leads toward improvement, and what it is that leads toward degeneracy.

They tell us that man and the other higher animals have evolved from lower forms of animals by selection, but those who make that statement overlook a very obvious absurdity in their claim. To have selection, parents must have offspring, and to have more selection the offspring must produce another generation, and these in turn another. Each generation gives opportunity for selection, and the more generations the more selection. Anything which would reduce the number of generations in a given period of time would reduce the opportunities for selection to accomplish anything.

At some time on the past there was a common ancestor for man and the higher apes. There have been less generations, and consequently less selection in the line leading from that common ancestor to man, than in the lines leading to the apes. Further back in the past there was a common ancestor for the higher apes and the lower monkeys. There have been less generations, and consequently less selection in the lines leading to the higher apes than in the lines leading to the lower monkeys. Extend that examination to the different species of active animals and you will find that each advance from a lower to a higher stage involved the elimination of selection, and that the actual advance has been inversely proportional to the amount of selection. Carried to its logical conclusion this means that the greatest possible advance will occur when selection is reduced to zero.

They tell us that acquired characters are not inherited, but I am telling you that the persons that make that statement never investi-

¹ Extracts from an address delivered in Chicago, Dec. 10, 1915, before the Eugenics Educational Society.

gated the matter and know nothing whatever about it. They simply repeat what they have been taught, and they cling to the dogma because it agrees with their preconceived ideas. The theory that acquired characters are not inherited originated in a misconception of what an acquired character is, and in an experiment which is absurd on its face.

To acquire means to obtain by effort, by exertion, by the performance of work. An acquired character is one obtained by exercising an organ, or by the work performed by the organ. It consists of a physiological change occurring within the organ which is dynamic in character and is called dynamic development. The amount of an acquirement is proportional to the amount of work performed. A mentally active man has a better developed brain at the age of fifty than he had at the age of twenty, and the difference is due to the extra amount of mental work performed.

If an acquirement is to be inherited, the parent must make the acquirement first and get the offspring afterwards, not get the offspring first and make the acquirement afterwards. Of those who deny the inheritance of acquired characters, what one ever took this into consideration and compared the progeny of parents of different ages on the basis of acquirements? Not one. They have failed to take even the first step in such an investigation whereas they should carry such a one through three or four generations of ancestors.

Among certain eugenists there is a theory that it is impossible to produce an individual which is superior to anything which previously existed. That is, if some very superior individual exists it is because there was, somewhere in his ancestry, a similar superior individual. This theory amounts to a denial of evolution and a return to the Garden of Eden story with Adam and Eve originally created equal to any individual who has since existed.

It is not clear how widely extended this theory is, but it seems to be back of the proposition to sterilize a large part of the population. That proposition is a public confession, by those who make it, that they know absolutely nothing about what causes improvement and what causes degeneracy. In their despair at seeing no way to improve the race other than that of killing off the inferior, they propose the killing process by indirection.

It seems never to have occurred to these gentlemen to write out the pedigree of some remarkable individual for three or four generations and then examine that pedigree for the purpose of learning if

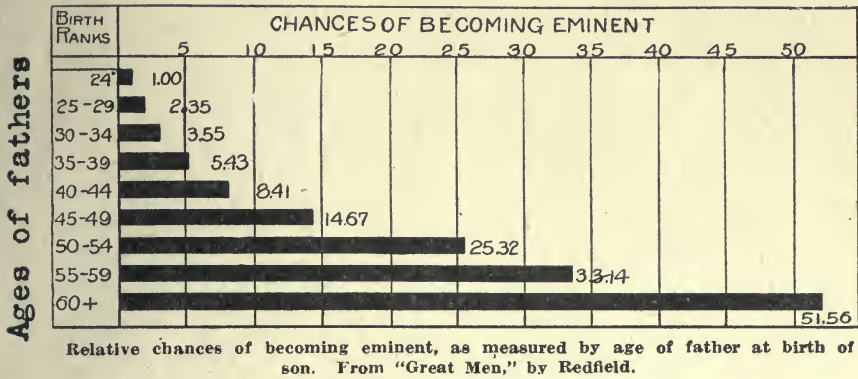
there was anything remarkable about the way he was produced. Wedded to a preconceived theory which they are anxious to support, they make statements without stopping to consider what those statements mean when carried to their logical conclusion.

Let us consider the horse. A century ago there was no horse in the world capable of trotting a mile in three minutes. Now we have horses which have trotted a mile in two minutes. This is an absolute and very great advance in power made in the past 100 years. It has been said repeatedly that this improvement came about through selection, but the statement is not true and is made in complete ignorance of the facts. Selection has been used abundantly among horses, but that selection is not connected with the improvement which has taken place.

High speed at the trot is not a natural gait for horses. It is an artificial gait which never existed in any breed of horses until forced there by the art of man. Less than a century ago the only high speed gait for horses was the run, and when trotters were forced for speed they would break into a run. Now we have "born trotters" which will stick to the trot no matter how hard they are forced, and trotting speed approaches running speed. Here is a new character in the trotters of today.

To have selection a mare must have several foals. If she produces but one foal in her entire life, there can be no selection in her line. It is take that foal or none. Write out the pedigree of any 2:10 trotter, it matters not what one, and extend that pedigree to the time when there was no such thing in the world as a 2:30 trotter. In that pedigree there will be from 5 to 20 mares, no one of which ever had more than one foal in her life. The other mares, and the sires in the pedigrees, will be found, on investigation, to have produced less than the normal number of foals. Also, the lines of improvement to our high speed trotters average only 7 generations to the century, while the normal number is 10 generations. Actual improvement came in those lines in which opportunity for selection was reduced to its lowest limit.

The same thing is true in intellectual power in man. Take any list of intellectually eminent men and you will find that they were sons of men much older than the average age of fathers when sons are born. A few will be found to be sons of comparatively young fathers, but push the investigation in those cases a little further and you will find that while it is possible to get an eminent man from a



young father it is impossible to get one from a succession of young parents. A succession of young parents always results in the production of mental inferiority, and, if the parents are unusually young, in such a succession the product is weak mentality.

To maintain any group of animals on a level in its power capabilities there must be a certain amount of acquirement per generation before reproduction. If the amount of acquirement is decreased there is a decline in power capabilities toward a lower corresponding level. If the acquirement is increased there is a rise toward a higher corresponding level. The age of parents at time of reproducing is one factor in measuring the amount of acquirement, and an investigation which did not consider this factor in at least three generations of ancestors would be superficial.

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BINET AND PORTEUS TESTS COMPARED. EXAMINATION OF ONE HUNDRED SCHOOL CHILDREN

The aim of this investigation was to compare the results obtained by examining normal school children by the Binet and by the Porteus series of tests. These latter were intended primarily to serve as an aid in the diagnosis of mental deficiency and are directed towards the testing of capacities in which the feeble-minded appear to be specially lacking. But it becomes evident to those who use them that this does not necessarily define the limits of their usefulness. Interesting results were expected from their application to normal children, especially when those results could be checked by the parallel use of the Binet scale. Their comparison is rendered easy because the Porteus tests are graded by years of chronological age.

The form of the Binet used was the latest revision by Dr. Goddard of America. The Porteus Tests were the same as those published in the Journal of Psycho-Asthenics for June, 1915, though a later method of scoring was adopted. This alteration consists in counting up the number of tests in which the child required the full number of trials allowed, in order to pass—two trials are allowed for Test 6 to 11 years, three trials for Test 12 to 13 years—and then making certain deductions from the highest test passed, in order to arrive at the mental age. If the full number of trials was required in two tests, one year is deducted, if in three tests $1\frac{1}{2}$ years are deducted, and if in four tests, 2 years; *e. g.*, A passes the 9 year test (2 trials), the 10 year test (2 trials), the 11 year test (2 trials), and then fails in the 12 and 13 year tests. Mental age equal 11 years (highest age passed) minus $1\frac{1}{2}$ years = $9\frac{1}{2}$ years. The child who “scrapes through” is thus penalized.

The children were selected for examination by the head teacher of the school, Miss Fleming, to whom I am much indebted for assistance and for permission to carry out the examination.

Table I shows the individual records. Column 4 shows the differences between the two mental age estimates by the two series.

Table II is a summary of Table I.

The children are placed higher by the Porteus Test than the Binet in 64 cases, lower in 36 cases. In 78 instances both series agree in classifying the children as being “at, above, or below age” mentally. In the remaining 22 cases they differ, though in 7 of these there is only a half year difference between the two estimates. They are, therefore, in practical agreement in 84% of the cases.

TABLE I
Individual Records

Case No.	Binet	Porteus	Difference	Age	Case No.	Binet	Porteus	Difference	Age	Case No.	Binet	Porteus	Difference	Age
1	5½	5	-1½	4½	35	8	7	-1	8½	68	10	10	0	9
2	6	6	0	7½	36	8	8	0	10½	69	10	11	1	10
3	6	6	0	4½	37	8	8	-0	8	70	10	11	1	11
4	6	6	0	5	38	8	8	0	9	71	10	10	0	12
5	6	7	1	5½	39	8	8	0	5½	72	10	11	1	8
6	6	5	-1	4½	40	8	9	+1	6	73	10	11	1	9½
7	6	6	0	5	41	8	5½	-2½	7	74	10	10½	½	9½
8	6½	8	1½	7½	42	8	8	0	7	75	10	13	+3	9
9	6½	7	½	7	43	8½	7	-1½	11	76	10	12	2	9
10	6½	7	½	5½	44	8½	7	-1½	6½	77	10½	12	1½	8½
11	6½	5	-1½	5½	45	8½	7	-1½	6½	78	10½	11	½	9½
12	6½	6	-½	5½	46	9	10	1	11	79	10½	7	-3½	8½
13	6½	7	+½	5½	47	9	7	-2	12	80	10½	12	+1½	8½
14	6½	6	-½	5	48	9	10	1	11	81	10½	8	-2½	7½
15	6½	6½	0	5	49	9	9	0	11	82	10½	8	-2½	10
16	6½	6	-½	5	50	9	9	0	10	83	10½	11	½	11½
17	7	7	0	6	51	9	8	-1	6½	84	10½	11	½	10
18	7	8	1	9	52	9	9	0	9½	85	10½	11	½	9½
19	7	10½	3½	8	53	9	10	1	7	86	11	11	0	9½
20	7	5	-2	6	54	9	10	1	7½	87	11	12	1	13
21	7	6	-1	6	55	9	8	-1	7	88	11	9	-2	13½
22	7	6	-1	5½	56	9	13	+4	10½	89	11	11	0	11
23	7	7	0	5½	57	9	7½	-1½	7½	90	11	12	1	13
24	7	7	0	5½	58	9	8½	-½	8	91	11	10½	-2	11
25	7	7	0	6	59	9	8	-1	7	92	11	11	0	10
26	7	7	0	6½	60	9	11	2	7	93	11	10½	-½	10½
27	7	8	1	6½	61	9	8½	-½	6½	94	11	12	1	14
28	7½	7	-½	5½	62	9½	9	-½	9	95	11	10	-1	11
29	7½	7	-½	9	63	9½	8	-1½	13	96	11½	13	1½	11
30	7½	5½	-2	6½	64	9½	9	-½	7½	97	11½	13	1½	12
31	7½	8	½	6½	65	9½	10	½	8½	98	11½	11	-½	13
32	7½	8	½	6	66	9½	10	½	10	99	11½	12	½	11½
33	8	9	1	7	67	9½	9	-½	6	100	12	13	1	11½
34	8	8	0	7										

TABLE II.

Summary of Differences
Binet and Porteus Results

No difference.....	24 cases
½ year.....	27 cases
1 year.....	25 cases

76

1½ years.....	11 cases
2 years.....	6 cases
2½ years.....	3 cases
3 years.....	1 cases
3½ years.....	2
4 years.....	1 cases

24

100

NOTE—In reckoning the ages of the children, 1, 2, and 3 months were disregarded; 4, 5, 6, 7, and 8 months were reckoned half a year, while for 9, 10, and 11 months a year was added to the age in years.

The coefficient of correlation by the Pearson formula works out at $r = .707$. Taking into account the different nature of the series, this correlation may be considered high.

In cases where there is wide difference in the estimate by the two series, the teacher's reports as to the attainments of the children are of special interest. A few of these are appended.

Case No. 47. Age 12 years. Binet 9, Porteus 7 (6 year—2 trials, 7 year passed—1 trial). Teacher: "Defective palate. Postnasal growth. Defective speech. Suffers from severe headaches. Probably feeble-minded."

Case No. 79. Age $8\frac{1}{2}$. Binet $10\frac{1}{2}$, Porteus 7 (7 year—2 trial, 8 year failed, 9 year—2 trials). Teacher: "Bright. Highly imaginative. Good memory. Good in all subjects except drawing, writing and modelling. Inclined to bully, untidy and impulsive."

Case No. 63. Age 13. Binet $9\frac{1}{2}$, Porteus 8 (8 year—1st trial, 9 and 10 failed). Teacher: "Indifferent. Shows no enthusiasm in her work. Reasoning power weak. Backward. Has attended a number of schools." Examiner's Note: "Unable to sustain attention except for very short periods. 60 words test (free association) 1st minute 30, 2d minute 10, 3d minute 8."

Case No. 88. Age $13\frac{1}{2}$. Binet 11, Porteus 9. Teacher: "In hospital two years for eye troubles. Probably mentally defective.

Case No. 43. Age 11. Binet $8\frac{1}{2}$, Porteus 7. Teacher: "Dull, no initiative. Finds it difficult to express thoughts on any subject. (Five in family, all probably defective.)"

Case No. 82. Age 10. Binet $10\frac{1}{2}$, Porteus 8. Teacher: "Dull, reasoning power weak. Diffidence in expressing thoughts. Attends school regularly, is attentive but makes very little progress."

Case No. 8. Age $7\frac{1}{2}$. Binet $6\frac{1}{2}$, Porteus 8 (8 year—2 trials, 9 year—2 trials). Teacher: "Dull, slow in answering. Language, number and reasoning weak. Not interested in work or play. Two in family mentally defective." Examiner's Note: "Very nervous, reluctant to talk."

Case No. 56. Age $10\frac{1}{2}$. Binet 9, Porteus 13 (10 year—2 trials). Teacher: "Bright. Good in arithmetic, geography. Language work weak. Impulsive. Subject to fits of bad temper. Defective palate."

Case No. 19. Age 8. Binet 7, Porteus $10\frac{1}{2}$ (8 year—2 trials, 10 year—2 trials, 12 year—3 trial). Teacher: "Dull. Mind in number work blank. Quiet, unresponsive. Does not mix with

children in playground." Examiner: "Painstaking, cautious, inclined to be slow and hesitating. Number work and comprehension poor."

Case No. 75. Age 9. Binet 10, Porteus 13 (12 year—3 trials). Teacher: "Very bright. Good command of language. Visualizes well. Reasoning power and memory very good. Enthusiastic. Likes to lead."

Case No. 81. Age $7\frac{1}{2}$. Binet $10\frac{1}{2}$, Porteus 8 (8 year 2 trials, 9 year—2). Teacher: "Very brief. Good reasoning powers. Observant, studious. Good in all subjects. Ambitious and always interested in work."

Case No. 41. Age 7. Binet 8, Porteus $5\frac{1}{2}$. Examiner's Note: "Very bright. Talks freely and intelligently. Very well developed on ideational side."

The above reports were furnished by the head teacher without knowledge of the result of the test. It will be seen how her reports frequently emphasize a view of the child's intelligence which one or other of the series of tests has failed to bring out, showing the necessity for supplementing one series by the other. The tendency of the Porteus tests appears to be to accentuate individual differences by marking the dull children lower, and the bright children higher than does the Binet.

In criticising the Porteus tests it should be borne in mind that they are not intended to be used alone, but are to be regarded as a very useful adjunct to the Binet scale. The capacities called into operation by these former tests appear to be principally forethought and prudence, ability to sustain attention, to improve with practice, and to resist misleading suggestions. No doubt the possession of these qualities is essential to the development of a moral sense and this fact probably accounts for the very poor showing that criminals make in these tests. The connection with general intelligence is not so easily worked. Yet the one who learns most rapidly from experiences is probably the person who goes slowly and surely, refusing to act blindly or impetuously, and who uses observation and discrimination. In so far as the Porteus tests enable us to try these capacities we can make a forecast of the probabilities of future development. It is quite possible for a child to succeed in these tests and yet be deficient in certain definite though limited directions, e. g., in number sense. But in general the capacities which make for success are

so important that the child possessing them is almost certain to be capable of training and improvement along important lines.

Some other points may be briefly summed up.

1. The Porteus Test requires but little time to apply—from ten to fifteen minutes is sufficient.

2. Results are not directly affected by previous school training.

3. Interest is aroused in the child by the puzzle element.

4. The response required being motor, not verbal, is a distinct advantage, when dealing with certain children such as deaf and dumb.

5. Success or failure in individual tests may be easily decided if instructions are adhered to strictly.

6. The tests provide the child with a situation wherein his reaction may be closely observed. Certain moral questions in the Binet are merely verbal problems. A significant commentary on such problems may be drawn from one of Binet's own questions, "Why do we judge of a person more by his acts than his words?"

7. The Porteus Tests require minor alterations and they undoubtedly may be graded more correctly according to the various mental ages. They are at present, easier, on the whole, than the Binet, when considered as general intelligence tests. It is worth while reiterating that they must be regarded as supplementary tests only. When we wish to measure the attainments of a child the mental map provided by the Binet is the more helpful. But if we wish to obtain a further insight into the child's nature and to estimate the importance of the relation between temperament and intelligence then the Porteus test can be recommended.

There must, however, be close observation of the child whilst he is performing the best trials. There is no statistical method of evaluating the various factors that make for success and the final result gives us merely a summary of operations.

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EDITORIAL

The history of any science reveals a curious pendular movement of human thought in its efforts to grasp and systematize the complex phenomena of nature. In a masterly paper on "The New Physiology" in a recent number of *Science* the eminent English physiologist, Dr. J. S. Haldane, gives an illuminating account of the present trend in that field. Until the middle of last century "it was generally held that in a living organism a specific influence, the so-called 'vital force,' controls the more intimate and important physiological processes. Inspired by the rapid advances of physics and chemistry, the younger physiologists of that time broke away from vitalism, and maintained that all physiological change is subject to the same physical and chemical laws as in the inorganic world, so that in ultimate analysis biology is only a branch of physics and chemistry. The subsequent progress of physiology has shown that all, without exception, of the physical and chemical hypotheses then advanced in explanation of intimate physiological processes were far too simple to explain the facts; but the general conclusion that biology is only a special application of ordinary physics and chemistry became firmly established, and is

still what may be called the orthodox creed of physiologists." The present swing of the pendulum is back, not to vitalism indeed, but to a system of inter-connected normals" so delicate in its balance and so marvelously responsive to slight changes in the environment that threaten to destroy this balance as to be quite beyond the possibility of explanation on the old mechanistic basis. "Each phenomenon of life, whether manifested in 'structure' or in 'environment' or in 'activity,' is a function of its relation to all the other phenomena, the relation being more immediate to some, and less to others. Life is a whole which determines its parts. They exist only as parts of the whole."

A similar swinging of the pendulum can be detected in psychology. Until the middle of the eighteenth century faculty psychology reigned supreme. Then came the English associationist school with its analysis of mental life into atomic sensations mechanically held together by mysterious bonds of association. This reached its climax in the work of the early psychological laboratories, and provoked the reaction of "functional psychology,"—a point of view which, according to Wundt, comes perilously near being a relapse into faculty psychology. There is little doubt that many of the explanatory terms of recent psychology are too formal and schematic. One need only cite the abuse of the term "instinct," which owes its vogue in American psychology chiefly to James, and upon which two of the most widely used books in educational psychology are constructed. Even so good a psychologist as Woodworth speaks in a recent lecture of "instincts and their importance throughout life as driving forces." Great credit is due to Thorndike for subjecting many of the so-called instincts to critical analysis and showing how little basis there exists for such sweeping terms as the instinct of play, the instinct of imitation, or the instinct of curiosity. The examination of specific instances of these activities shows that we have to do with the functioning of an inherited organism more or less highly modified by experience. In no case must the experiential factor be overlooked. Thus the so-called instincts are in principle not a whit different from playing the piano, writing good English, or mastering geometry. The difference is only one of degree. As in physiology so in educational psychology the present trend is away from explanations in mechanistic or mystical terms toward correlations of activities and the discovery of the "inter-related normals" on which the learning process depends.

J. C. B.

NOTES AND NEWS

The sixty-ninth meeting of the American Association for the Advancement of Science will be held in New York City December 26-30. This is the first of the greater convocation-week meetings which are hereafter to be held once every four years in the large centers of population, as New York, Chicago, Washington, etc. A record attendance is expected, and is it prophesied that this will be the greatest meeting of scientific men ever held in this country or elsewhere. The meetings of Section L (Education) promise to be of particular interest. The main topic will be "Educational Measurements," and over fifty papers have been received describing experimental studies of pupils' attainments, methods of teaching, supervision, and use of the school plant. In affiliation with this meeting will be held the twenty-fifth annual meeting of the American Psychological Association, December 27-30, at Teachers College, Columbia University. The address of the president, Professor Raymond Dodge, will be on "The Laws of Relative Fatigue," and on Friday afternoon the twenty-fifth anniversary of the founding of the association will be celebrated in a series of papers by G. Stanley Hall, J. McKeen Cattell, Joseph Jastrow and John Dewey.

The New York Branch of the American Psychological Association held its first meeting for the academic year on Monday evening, November 27, at Columbia University. The following papers were read: "Echolalia in Idiots: Its Meaning for Modern Theories of Imitation," by L. S. Hollingworth; "The Shrinking of Images," by G. C. Myers; "A Comparison of the Binet-Simon Tests of Intelligence and the Squire Graded Mental Tests," by J. C. Bell.

On Saturday, October 28, a "Conference on Aspects of Psychological Examination" was held at the Massachusetts School for Feeble-Minded, Waverley, Massachusetts. The following papers were presented: "Present Status of Methods for Measuring Intellectual and Affective Reactions," by R. M. Yerkes; "Brain Complexity in Relation to the Results of Psychological Examinations," by E. E. Southard; "Methods of Detecting and Measuring Mental Deterioration," by S. L. Pressey; "A Point Scale for the Measurement of Intelligence in Adolescent and Adult Individuals," by C. S. Rossy; "The Weighing of Point Scale Tests: A Criticism of the Original Point Scale and Suggested Improvements," by Rose S. Hardwick; "Criteria

for the Proper Evaluation of Tests and Test Series," by Florence Mateer; "The Significance of Point Scale Coefficients of Intelligence," by Louise Wood; "Comparison of Point Scale and Binet Measurements of Mental Defectives in the School for Feeble-Minded at Waverley," by Josephine M. Curtis; "Studies of Intellectual Defectives and Cases of Dementia Praecox by the Multiple Choice Method," by C. S. Rossy; "The Standardization of Supplementary Psychological Methods at the Psychopathic Hospital," by Marjorie H. Rossy; "A Method of Measuring Ideational Efficiency," by R. M. Yerkes.

At the Voice Clinic, Psychopathic Department, Boston State Hospital, under the leadership of Dr. Walter B. Swift, five series of papers have been presented on the general topic of "Universal Mental Measurement." The first series, on October 22, 1915, dealt with "The Philosophy of Mental Measurement"; the second, on February 25, 1916, "The New Basis of Mental Measurement"; the third, on October 6, 1916, "Critique of Tests"; the fourth, on November 3, 1916, "Finer Mentation that may be Tested"; and the fifth, on November 27, 1916, "Technique for the Medical System of Mental Tests." On December 15 Dr. Swift will discuss "A New Philosophy of Life based upon Developmental Psychology."

A "New York Committee on Feeble-Mindedness" has been organized with the following objects: Early care, training and supervision of all mental defectives in the state; measures and methods for preventing a future increase in the number of the subnormal; establishment of special classes in the public schools; establishment of a system of guardianship and supervision in the home to supplement institutional and farm colony care; double the number of places for the feeble-minded and epileptic in New York state institutions. The executive secretary is James P. Heaton, United Charities Building, New York City.—*School and Society*.

Dr. Alexander Johnson, for thirteen years secretary of the National Conference of Charities and Correction, has been selected as the expert for the Colorado State Survey Commission to investigate and make recommendations concerning the care of mental defectives and insane in the state, and the charities and corrections departments of the state.—*Science*.

The orthopedic department of the Children's Hospital, Boston, will offer a course, beginning on December 1, 1916, in muscle training and in the principles of the nursing aftercare of infantile paralysis.—*Science*.

PUBLICATIONS RECEIVED

MAURICE A. BIGELOW. *Sex Education. A Series of Lectures Concerning Knowledge of Sex in its Relation to Human Life.* New York: The Macmillan Company, 1916. Pp. xi, 251. \$1.25.

This excellent discussion of various phases of sex education from the pen of one of the leaders in biological study will be cordially welcomed by those who are confronted by the problems of sex in the education of boys and girls. The author agrees with those who claim that sex instruction should be given in the home, but he also recognizes the fact that few parents are able and willing to carry this instruction to the point where it will be really helpful in controlling conduct. It is therefore necessary to go beyond the home and to include a consideration of the fundamental facts of sex in the work of the schools. Chapter two presents clearly and succinctly eight problems for sex education, and the remainder of the book is devoted largely to the solution of these problems. The writer recognizes the danger of suddenly thrusting sex education into the course of study by legislative enactment and believes the greatest of care should be exercised in the choice of teachers. In some cases sex instruction may be profitably given in biology classes containing both boys and girls, but in general a better attitude can be secured by teaching boys and girls in separate classes with teachers of the same sex. There is a consideration of the phases of sex instruction to be emphasized in the pre-adolescent years, in early adolescence, and in late adolescence. A selected bibliography of eight pages is included.

EDWIN F. BOWERS. *Alcohol—Its Influence on Mind and Body.* New York: Edward J. Clode, 1916. Pp. ix, 207. \$1.25.

The author of this book arrays the opinions and findings of physicians, physiologists, statisticians, and managers of industry in an appeal to the average man to realize the evils of the drink habit and the sale of alcoholics. It could scarcely be called an unbiased scientific discussion, but is rather a vigorous brief for the cause of abstinence.

GEORGE VAN NESS DEARBORN. *Notes on Affective Physiology.* Reprinted from the Medical Record, April 8, 1916. Pp. 63.

A valuable survey of recent experimental and theoretical work on emotional reactions, with a bibliography of forty-six numbers. The author believes that the traditional division of emotional behavior into eighty or more feelings or emotions will be soon abandoned for a simpler classification on the basis of the complex oppositions which biologically underly all of these shades of feeling. The chief of these oppositions is that between impulse and personal control.

GEORGE VAN NESS DEARBORN. *Movement, Cenesthesia, and the Mind*. Reprinted from the *Psychological Review*, Vol. 23, May, 1916, 190-207.

The author pleads for a broader and more basic conception of psychology than that which is characteristic of most of our research laboratories. The factors of movement and of adjustments to situations have been too much ignored. In general the article leans to the behavioristic point of view, and the claim is made that psychology is perfectly well-fitted to be a popular and essential grammar school subject.

JOHN DEWEY. *Essays in Experimental Logic*. Chicago: University of Chicago Press, 1916. Pp. vii, 444. \$1.75.

In 1903 the author published a volume entitled *Studies in Logical Theory*, containing essays by himself and his pupils. The edition of the *Studies* has been exhausted, and in the present volume the author has reissued those portions of the previous work which he himself wrote, and has added a number of essays of similar nature. The chapters deal with such topics as the relationship of thought and its subject-matter, the antecedents and stimuli of thinking, data and meanings, the object of thought, the logical character of ideas, control of ideas by facts, naive realism versus presentative realism, the existence of the world as a logical problem, what pragmatism means by practical, and the logic of judgments of practice.

E. A. DOLL. *Note on the "Intelligence Quotient."* Reprinted from the *Training School Bulletin*, April, 1916.

The author proposes a scheme of classification of children, from the feeble-minded through the normal to the talented, on the basis of the "intelligence quotient."

E. A. DOLL. *Preliminary Note on the Diagnosis of Potential Feeble-mindedness*. Reprinted from the *Training School Bulletin*, May, 1916.

A systematic consideration of the lines of investigation that need to be followed up in arriving at a conclusion as to whether a child will probably be feeble-minded or not.

KNIGHT DUNLAP. *The Results of a Questionary on Psychological Terminology*. Johns Hopkins University Circular, Whole No. 285, May, 1916, No. 5. Pp. 55.

Eleven questions regarding the use of such terms as experience, consciousness, thought, and sensation were sent to the senior members of the American Psychological Association. The monograph presents a detailed tabulation of the replies. The author concludes that the term "experience" seems hopeless of standardization and should be

abandoned as a scientific term. The term "consciousness" has lost many of its metaphysical meanings and there is a tendency to use it to indicate awareness in general.

GEORGE OSCAR FERGUSON, JR. *The Psychology of the Negro. An Experimental Study.* Archives of Psychology, No. 30, April, 1916. Pp. 138. \$1.25.

This monograph reports the results of extensive comparative tests of negroes and white children in the schools of Richmond, Fredericksburg, and Newport News, Virginia. The following tests were used: mixed relations, completion, maze, and cancellation. Twenty-five pages are devoted to a review of work previously done, and the last fifty pages deal with classifications of negroes and the conclusions that may be drawn from the study. The detailed scores of the results of the tests will be of value for comparison with other school children. The author concludes that the average performance of the colored population of the country is only about three-fourths as efficient as the performance of whites with the same amount of training.

DOROTHY CANFIELD FISHER. *Self-Reliance.* Indianapolis: The Bobbs-Merrill Company, 1916. Pp. 243. \$1.00.

In this book the author takes up in easy conversational style some fundamental problems in education. In a certain sense the book might be characterized as an application of the Montessori principles to child life in the home and in the school. The educative value of self-help even in early childhood, and the manifold ways in which adults thoughtlessly interfere with the child's self-education are illustrated by numerous anecdotes. Later the Robinson Crusoe impulse manifests itself, and should be thoughtfully fostered by parents and teachers. The author has a rather scathing denunciation of the herding of pupils in schools, and foresees dire consequences from the suppression of individuality and initiative entailed by these conditions.

ABRAHAM FLEXNER AND FRANK P. BACHMAN. *Public Education in Maryland.* Second Edition. New York: General Education Board, 1916. Pp. xviii, 230.

The second edition of this report contains an appendix of 54 pages embodying the new education laws of the state of Maryland adopted at the last session of the legislature.

FRANK N. FREEMAN. *Experimental Education. Laboratory Manual and Typical Results.* Boston: Houghton, Mifflin Company, 1916. ix, 220. \$1.30.

There is a growing consciousness among teachers of educational psychology and education that the ordinary laboratory manuals of psychology are quite inadequate for the training of students in edu-

cation. The first departure was Starch's laboratory manual of educational psychology, which did not get very far from the traditional type of laboratory exercise. A laboratory manual more intimately connected with the subject matter of education courses has been greatly needed. Moreover during the past ten years the experimental material available for such a manual has grown at a rapid rate. It is with the object of systematizing this material and making it available for laboratory purposes that the present book was written. In his introduction the author points out that the earlier work in educational psychology was conducted by professional psychologists with the aim of making an application of general psychological principles to education. The procedure of this book is precisely the opposite: "It attacks directly the practical problems and attempts to throw light upon them by an analysis of the psychological principles which are involved in them." Sixteen experiments are presented, arranged in three groups. Group one is concerned with an analysis of various types of the learning process. It includes a modified mirror reaction experiment; perceptual learning, involving the reproduction of a complex figure; puzzle solving; transfer of training and mirror reactions; rote memorizing; and memory for sense material. Group two consists of experiments in school subjects, including an experimental analysis of hand writing, the measurement of handwriting, observation of eye movements in reading, techistoscopic studies of reading, the measurement of efficiency of reading, and the application of number. Group three is devoted to tests, and there are directions for testing visual acuity, auditory acuity, immediate memory for numbers, the reconstruction of sentences, and correlations between the tapping test, pitch discrimination, and the opposites test. Each chapter is followed by a set of questions and topics for discussion and a few selected references. The book is a noteworthy advance over any laboratory manual at present available for classes in education.

SIDONIE MATZNER GRUENBERG. *Sons and Daughters*. New York: Henry Holt and Company, 1916. Pp. vi, 328. \$1.40.

A series of non-technical talks on fundamental factors in education. Some of the titles are Modern Parenthood, The Physical Basis of Development, Individual Differences, The Changes of Adolescence, Types of Difficult Children, Pugnacity, Character as Habit Formation, The Management of Children, The Child and Society. The book is composed largely of illustrative anecdotes.

THOMAS H. HAINES. *A Mental Survey of the Ohio State School for the Blind*. The Ohio Board of Administration, Publication No. 9, January, 1916. Pp. 24.

There is a detailed study of age distribution, an evaluation of intelligence by means of the Yerkes Point Scale, a comparison of blind with seeing children, and a description of eight cases of feeble-

minedness. Twenty-one persons were found to be so definitely feeble-minded that they were unable to profit from the work of the school.

DAVID SPENCE HILL. *Industry and Education. A Preliminary Study of Manufacturing Establishments in New Orleans and Mechanical Occupations of Boys and Men with Reference to Education, and a Plan for the Delgado School.* New Orleans: The Commission Council, June, 1915. Pp. xiii, 409.

The present report embodies the results of one of the most detailed and systematic surveys of the industries of a community from the point of view of school work that has yet been published. Among the industries studied were the mental working industries, power, light, and heating plants, electrical manufacturing and construction, including telephone and telegraph systems, lumber and its manufactured products, the building trades, printing and publishing, nautical employments, sea-food industries, and scientific agriculture. In each of these industries the attempt was made to determine exactly the amount and quality of labor demanded, and the measures that the school might take for preparing pupils to better meet the demand.

GEORGE BURTON HOTCHKISS AND CELIA ANNE DREW. *Business English, Its Principles and Practice.* Cincinnati: The American Book Company, 1916. Pp. viii, 376.

This is an attempt to adapt the English work of the schools to the demands of business life. Part one deals with the essentials of business English; part two with business forms and usages, including business, official, and social letter writing; part three with the details of business correspondence, and part four with sales letters and advertising. Aside from the training in English the book contains much information on the conduct of modern business.

CHARLES HUBBARD JUDD AND SAMUEL CHESTER PARKER. *Problems Involved in Standardizing State Normal Schools.* Bulletin 1916, No. 12, Washington: Bureau of Education, 1916. Pp. 141. 15c.

The bulletin contains a comparison of colleges and normal schools, a study of the services rendered by normal schools in typical states, their administrative control, facilities for practice teaching, size and equipment of faculties, and the training offered by the courses of study. The final chapter considers a plan for developing normal school standards.

TRUMAN LEE KELLEY. *Tables to Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations.* Bulletin of the University of Texas, 1916, No. 27, May, 1916. Pp. 53.

These tables are constructed to reduce the labor involved in the calculation of partial coefficients and regression equations. In his introduction to the tables Professor E. L. Thorndike says, "Twenty years ago the ordinary coefficient of correlation for one series of

paired values was a recondite mathematical technique just beginning to be used by a few biometricians. Now it is a stock means of measuring resemblance or correspondence employed when appropriate by all competent investigators. The same career might be prophesied for partial coefficients of correlation but for the complexity and tediousness of the computations involved. It is the service of Dr. Kelley's tables to reduce these." In a few pages the author develops the theory of partial coefficients and regression equations and gives an outline for the calculation of regression coefficients. The tables themselves occupy approximately 30 pages.

MARY STORER KOSTIR. *The Family of Sam Sixty*. Columbus: The Ohio Board of Administration. Publication No. 8, January, 1916. Pp. 29.

This is an interesting study of a family embracing 474 representatives, on 261 of whom some data has been secured. There are detailed descriptions of individuals and seven geneological charts. The study is similar to Goddard's *Kallikak Family*, and is of great interest to criminologists and students of heredity.

WILLIAM D. LEWIS AND JAMES FLEMING HOSIC. *Practical English for High Schools*. Cincinnati: The American Book Company, 1916. Pp. 415.

The authors have set for themselves the following principles in the construction of this book. One, a textbook should be primarily a laboratory guide; two, the pupils should learn not a theory but a method of work; three, practice in expression has little value unless it grows out of a real situation; four, both good speech and good writing are matters of habit; five, much of the material in the books now used is over-mature, ambitious, and unrelated to the thoughts of young people; six, great stress should be laid on social and business letters, newspapers, and magazines; seven, the best teaching requires a real social situation in the classroom. It will be interesting to see whether these two well-known radicals in education have been able to produce a practical textbook in high school English.

JASPER L. MCBRIEN. *America First. Patriotic Readings*. Cincinnati: American Book Company, 1916. Pp. 288.

A collection of readings from various sources adapted to patriotic occasions.

HERBERT ADOLPHUS MILLER. *The School and the Immigrant*. Cleveland: The Cleveland Education Survey, 1916. Pp. 102. 25c.

The author presents a statistical study of children from non-English speaking homes, details the efforts of the national groups to preserve their languages, discusses the characteristics of the national groups and considers the problem of education for these children. The work that should receive the greatest emphasis with these children is a mastery of speaking, reading, and writing the English language.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A PRELIMINARY STUDY OF THE MEASUREMENT OF ABILITIES IN GEOMETRY

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INTRODUCTORY

The past five or six years have witnessed a very promising activity in the experimental study of the abilities of elementary school pupils, in the construction of scales to measure attainments in elementary subjects, and in the application of these scales to evaluate progress in school work, but as yet very little attention has been paid to the accomplishments of pupils in secondary school subjects. The studies of Monroe,¹ Rugg² and Childs³ in algebra, of Hanus⁴ in Latin, and of T. L. Kelley⁵ in his monograph on *Educational Guidance* include practically all of the experimental work that has been reported. Yet there is no period of intellectual development in which individual differences are more marked, or in which more careful account needs to be taken of these differences for the best interests of the child's progress in school work than the high school period. School authorities have paid much attention to the differentiation of the curriculum to meet various needs, but have given little thought

¹ WALTER S. MONROE. *A Test of the Attainment of First Year High School Students in Algebra*. School Review, 23: 1915, 159-171.

² H. O. RUGG. *The Experimental Determination of Standards in First Year Algebra*. School Review, 24: 1916, 37-66.

³ H. G. CHILDS, University of Indiana. (Unpublished.)

⁴ PAUL H. HANUS. *Measuring Progress in Learning Latin*. School Review, 24: 1916, 342-351.

⁵ TRUMAN LEE KELLEY. *Educational Guidance: An Experimental Study in the Analysis and Prediction of Ability of High School Pupils*. Teachers College Contributions to Education, No. 71, 1914. Pp. 116.

to the aptitudes of pupils, or their fitness for and success in the different subjects that they take. Particularly in geometry would it seem that experimental studies in the progress of pupils and in the profit derived from their course are called for. The study of geometry is generally required of high school pupils for at least one year. Of all the arguments made in defense of this requirement the plea of "formal discipline" has undoubtedly had the greatest weight. It is traditionally accepted that no school subject has such efficacy in "training the reasoning faculty" as geometry. No matter how severe the buffetings that "formal discipline" may receive at the hands of experimental psychology, this idea is firmly fixed in the minds of school administrators and of intelligent laymen. Such a traditional belief challenges experimental study.

But before much progress can be made in determining the degree to which the study of geometry develops reasoning in other lines, we need to know more definitely how pupils who have taken the ordinary high school work in geometry react to geometrical situations themselves. It was in the hope of throwing some light on the latter question that the present study was undertaken. In the field of experimental studies bearing on abilities in geometry, Metzler⁶ and Yocum⁷ have suggested a number of problems that might profitably be investigated, but have made no researches themselves. Kelley, in the study mentioned above, used a geometry test containing ten questions. One of these required imagery of the results of a cut in a folded paper, five were simple locus problems involving no knowledge of geometry, one was a ratio problem, and three were problems in syllogistic logic. To what extent such exercises are indicative of ability in geometry is a question which need not be discussed here. As the study was one in correlation, the gross results of the tests were not indicated. Courtis⁸ has devised a number of reasoning tests which can be given to pupils who are about to take up geometry, and which may furnish indication of ability in the subsequent study of the subject, but no results of their application are at hand.

The authors are keenly aware of the incompleteness and inconclusiveness of the present study. It was their intention to give the data a more adequate and detailed statistical treat-

⁶ W. H. METZLER. *Problems in the Experimental Pedagogy of Geometry*. Journal of Educational Psychology, 3: 1912, 545-560.

⁷ A. DUNCAN YOCUM. *A First Step in Inductive Research into the Most Effective Methods of Teaching Mathematics*. School Science and Mathematics, 13: 1913, 197-210.

⁸ S. A. COURTIS, Detroit, Mich. (Unpublished.)

ment, but through an unfortunate accident the original papers were lost, and it was thought best to publish the results already worked out.

CONSTRUCTION OF THE TESTS

In devising the list of questions for the test the attempt was made to call for information that is to be found in all standard text books; to test for important and fundamental principles of geometry; to provide such a range of questions as to be representative of the whole field of elementary geometry, and include memory facts, knowledge of context, organization of subject matter, and power to do "originals"; and to confine the list to such dimensions that every question could be tried by the average high school pupil in a period of forty minutes. These demands are not easy to fulfill, and it was subsequently found that the list finally adopted was too long for the slower workers.

A preliminary set of questions was drawn up, submitted to the criticisms of professors of mathematics, high school teachers of mathematics, and advanced students of education, and tried on four classes of high school pupils. On the basis of these criticisms and results the list was revised and printed in the following final form:

THE QUESTIONS

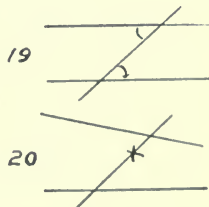
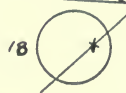
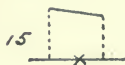
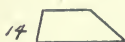
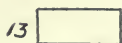
School Date Time used
Pupil Age Sex Grade

Take the following questions in the order given, omitting none. Place a cross (X) after any question you consider but can not answer. In case you do not finish, draw a line under the last number considered. Make your answers brief but clear. Do not use the left hand margin.

I. Draw small freehand figures *after* each of the following terms to illustrate its meaning:

- | | | |
|------------|------------|---------------------|
| 1. Circle | 5. Angle | 9. Diagonal |
| 2. Rhombus | 6. Sector | 10. Transversal |
| 3. Square | 7. Tangent | 11. Central angle |
| 4. Hexagon | 8. Chord | 12. Inscribed angle |

II. Write after each figure its name or the name of the marked part:

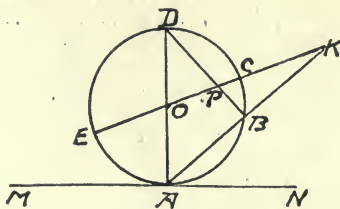


III. 21. Indicate the order in which the propositions relating to the following areas should be developed: Circle, triangle, parallelogram, rectangle, regular polygon.
(1) (2) (3) (4) (5)

IV. Complete the statement of the following:

22. The line joining the mid points of two sides of a triangle. . .

23. The diagonals of a parallelogram. . . .
24. If from a point without a circle a secant and a tangent are drawn. . . .
25. The bisector of an interior angle of a triangle divides the opposite side. . . .
26. Line segments are equal, if they are
(a)
(b)
- V. State the *converse* of each of the following, and tell whether it is true by writing "yes" or "no" after what you have written:
27. If two lines in the same plane are cut by a transversal so that the alternate-interior angles are equal, the lines are parallel.
28. The diagonals of a rectangle are equal.
- VI. Define accurately:
29. Parallelogram.
30. Circle.
- VII. 31. Name five regular polygons which you have learned to inscribe in a circle:
(1) (2) (3) (4) (5)
- VIII. 32. Name the parts of a theorem:
(1)
(2)
33. Outline the steps in an *indirect proof*:
(1)
(2)
- IX. Solve:
34. In a certain right triangle the acute angles are $2x$ and $7x$. Find the value of each acute angle.
35. What is the angle whose supplement is three times its complement?
- X. 36. The area of a trapezoid is equal to half the sum of its bases by its altitude. (Draw figure and prove in full. Work may be shortened by using algebraic methods.)
- XI. In a regular polygon of n sides, *indicate* how many degrees in:
37. The sum of the interior angles.
38. The sum of the exterior angles.
39. One interior angle.
40. One exterior angle.



- XII. Given: O the center of the circle, arc $AB = 70^\circ$, arc $DC = 80^\circ$. Find the number of degrees in the following angles:
(Hint.—How many degrees in arc BC? In arc AE?)
41. Angle EOA
42. Angle BAN
43. Angle BAD
44. Angle EKA
45. Angle BPC
- XIII. 46. Indicate by drawing small freehand figures and by marking the necessary lines and angles (or by the use of letters) the general cases of the congruency of triangles:
(1)
(2)
(3)
- XIV. 47. State three cases of the similarity of two triangles:
(1)
(2)
(3)

- XV. 48. What two conditions are necessary and sufficient to show that a line or group of lines is a required locus?
 (1)
 (2)
49. Draw or describe the locus of a point one-half inch from a given circle with radius r .
50. What is the locus of points equidistant from the sides of a given angle? (Draw figure.)
51. What is the locus of the vertex of the right angle C of a right triangle constructed upon a given hypotenuse AB ? (Draw figure.)
- XVI. 52. Draw a small triangle and then draw the auxiliary lines (dotted lines) needed in proving that the sum of the angles of the triangle is equal to 180 degrees.
 In an *auxiliary construction*:
53. How far is a line usually produced?
54. Into how many parts is a line or angle usually divided?
55. Is a line often drawn otherwise than parallel or perpendicular to some prominent line of the figure?
- XVII. Show by small freehand figures how to make the following constructions:
56. The perpendicular bisector of a line.
57. A circle inscribed in a triangle.
58. The division of a line into three equal parts.
59. The construction of a square equivalent to two given squares.
- XVIII. 60. Find a mean proportional to 4 and 16.
61. Find a fourth proportional to 3, 5, and 6.
62. Find a third proportional to 4 and 6.
63. What is the ratio of two similar polygons whose corresponding sides are 5 and 7?
64. What is the ratio of the perimeters of the two polygons in (63)?
- XIX. Write an algebraic formula to express each of the following areas:
65. A parallelogram with base a and altitude h .
66. A rectangle with sides a and b .
67. A triangle with base a and altitude h .
68. A trapezoid with bases a and b , and altitude h .
69. A circle with radius r .
- XX. 70. Name in proper order the steps that must be taken to construct a square equivalent to any given polygon:
 (1)
 (2)

It will be noticed that the questions are numbered consecutively from 1 to 70, and that they are arranged in twenty groups. These groups involve drawing figures, naming figures, indicating order of development in demonstration, completing statements, stating the converse, definitions, regular polygons, parts of a demonstration, angular relations, area of a trapezoid, angles in polygons, angles in circles, congruency of triangles, similarity of triangles, loci, auxiliary lines, simple constructions, ratio and proportion, algebraic expression of geometrical relations, and equivalent construction.

THE RESULTS

Results were obtained from classes in four representative Texas high schools, one class in a normal school, and one section of the freshman class in the University of Texas. In all 372 papers were

received. In the high school from which the largest number of returns were received one of the writers (Stockard) conducted the test in person, in the other schools the test was given by the regular teachers. The accompanying figures, with the exception of Figure II, give data for high schools only. The results from the normal school were similar to those from the high schools, except that they were slightly higher, while those from the University were appreciably lower. The probable reason for this is that the university students were farther removed from their study of plane geometry than the normal and high school pupils. All of those tested had had one year of plane geometry, but some had just finished it, while others had taken the work one or two years previously. In the latter case they had continued with some sort of mathematics, or all those tested (except the university freshmen) were in mathematics classes.

In tabulating the results all questions were regarded as having equal value, and were counted as "right" "wrong," or "not attempted." Inspection of Table I and Figure I, however, shows great inequality in the difficulty of the questions, and points to the need for a "weighted" score.

Table I shows the total number of high and normal school pupils attempting each problem, the number of pupils answering each problem correctly, and the percentage of correct replies. It will be noted that the dropping off in the number attempting the problems is due chiefly to the time limit. This disturbs the significance of the percentages in the later problems to some extent, since it is evident that we have to do with a more and more highly selected group of speedy workers. If the speedier workers are also the more accurate workers, the percentages are higher on the later problems than they would have been if all the pupils had been given time enough to attempt all the problems. But are the speedier workers also the more accurate? An attempt to check this up on the basis of the first thirty problems (which were attempted by practically all the pupils) showed that this was not the case,—that the speedy workers made about as many mistakes as the slow ones. In the absence of evidence to the contrary, therefore, we shall assume that the percentages, even on the later problems, fairly represent the relative difficulty of the problems.

If we assume that the distribution of abilities in these tests corresponds to the normal distribution curve, we may transform

TABLE I.
Scores of Normal and High School Pupils

No. of Problem	No. of Pupils Attempting Problem	No. of Correct Solutions	Per cent. Correct	P. E.	P. E. Units	Weightings	No. of Problem	No. of Pupils Attempting Problem	No. of Correct Solutions	Per cent. Correct	P. E.	P. E. Units	Weightings
1	351	351	100.0	-5.00	1	.003	36	336	172	51.2	-.05	495	1.5
2	351	225	64.2	-.54	446	1.4	37	307	82	26.7	+.93	593	1.8
3	351	351	100.0	-5.00	1	.003	38	304	56	18.4	+1.33	633	2.0
4	351	341	97.2	-2.81	219	.7	39	303	60	19.8	+1.26	626	2.0
5	351	350	99.9	-4.60	40	.124	40	302	40	13.3	+1.65	665	2.1
6	351	147	41.9	+.30	530	1.7	41	295	164	55.6	-.22	478	1.5
7	351	348	99.1	-3.50	150	.47	42	294	127	43.2	+.25	525	1.6
8	351	332	94.6	-2.38	262	.8	43	293	109	37.3	+.48	548	1.7
9	351	340	96.9	-2.78	222	.7	44	290	74	25.5	+.98	598	1.9
10	351	340	96.9	-2.78	222	.7	45	286	47	16.4	+1.51	651	2.0
11	351	337	96.0	-2.60	240	.8	46	280	227.3	81.1	-1.31	369	1.2
12	351	314	89.6	-1.90	310	1.0	47	269	166.6	61.9	-.45	455	1.4
13	351	296	84.4	-1.50	350	1.1	48	253	113	44.7	+.20	520	1.6
14	351	216	61.6	-.44	456	1.4	49	245	76	31.5	+.71	571	1.8
15	351	181	51.6	-.06	494	1.5	50	241	105.5	43.8	+.23	523	1.6
16	351	90	25.6	+.97	597	1.9	51	234	28.5	12.2	+1.74	674	2.1
17	351	329.5	93.7	-2.27	273	.9	52	219	102	46.6	+.15	515	1.6
18	351	216	61.6	-.44	456	1.4	53	213	12	5.6	+2.35	735	2.3
19	351	264	75.3	-1.02	398	1.2	54	207	121	58.5	-.31	469	1.5
20	351	303	86.4	-1.63	337	1.1	55	206	127	61.6	-.44	456	1.4
21	351	131	37.3	+.48	548	1.7	56	201	95	47.3	+.11	511	1.6
22	351	189.5	54.0	-.15	485	1.5	57	198	81	40.9	+.34	534	1.7
23	351	233.5	66.4	-.68	432	1.3	58	193	109	56.5	-.24	476	1.5
24	350	186.5	53.2	-.14	486	1.5	59	190	73	38.4	+.44	544	1.7
25	350	125.5	35.9	+.54	554	1.7	60	165	89.5	54.3	-.16	484	1.5
26	350	130.5	37.3	+.48	548	1.7	61	161	80.5	50.0	0	500	1.6
27	350	248.5	70.9	-.82	418	1.3	62	158	49.5	31.3	+.72	572	1.8
28	350	26.5	7.5	+2.13	713	2.2	63	154	40	25.9	+.96	596	1.9
29	350	242.5	69.4	-.75	425	1.3	64	150	42	28.0	+.86	586	1.8
30	350	228	65.2	-.57	443	1.4	65	143	109	76.3	-1.06	394	1.2
31	349	266	76.3	-1.06	394	1.2	66	141	122	86.6	-1.66	334	1.0
32	345	218.5	63.4	-.51	449	1.4	67	140	115	82.2	-1.37	363	1.1
33	345	77.5	22.4	+1.13	613	1.9	68	139	89	64.1	-.54	446	1.4
34	343	248.5	72.5	-.88	412	1.3	69	139	82.5	59.4	-.35	465	1.5
35	338	76	22.5	+1.12	612	1.9	70	131	30.5	23.3	+1.08	608	1.9

the percentages into values of P. E. by making use of Thorndike's table.⁹ These values are indicated in the column marked P. E. in Table I. It should be noted that since problems 1 and 3 had 100 per cent. correct, it is impossible to calculate a P. E. value for them. Quite arbitrarily they were given the value -5.00 P. E., and in lieu of any zero point experimentally determined

⁹ EDWARD L. THORNDIKE. *Mental and Social Measurements*. New York: Teachers College, Columbia University, 1913. P. 200.

for the tests their difficulty was set at 1 P. E. unit. The other difficulty measures in the column marked P. E. Units were found by multiplying the P. E. values by 100 and subtracting them from or adding them to the 500 units representing the assumed distance of Problem 1 from the median. These P. E. Units were then reduced to the basis of a scale of 100 points for the entire test, and each problem was given its proportionate weighting on such a scale, as is shown in the column marked "Weightings."

Figure I represents graphically the showing made on the entire set of seventy questions by the four high schools taking part in the test. "Per cent. right," as shown here, represents the number of pupils answering correctly, divided by the number of pupils taking part in the test from that school. With a few exceptions the curves parallel each other throughout.

Considering the results presented in Table I and Figure I somewhat more in detail, it is to be noted that, as one would expect, group I is on the whole the easiest, although questions 2 and 6 are of approximately median difficulty (the median in this array is problem 60, with a correctness percentage of 54.3, 484 P. E. Units, weighting 1.5). The term "central angle" (11) seems to be appreciably more familiar than "inscribed angle" (12). Hexagon (4), diagonal (9) and transversal (10) are equally familiar, but chord (8) is almost twice as difficult as tangent (7). That sector (6) and segment (16) both rank high in difficulty will not surprise teachers who have labored to get pupils to distinguish them. Group II is on the whole decidedly harder than group I, even the triangle giving considerable difficulty. In advance of the test the authors would not have guessed that the rectangle (13) was slightly less familiar than the transversal (20). Since question 10 and question 20 refer to the same thing it is interesting to note that the word (transversal) is much more readily illustrated than the object is named.

The hardest group was group XI (questions 37-40), having to do with the angles of regular polygons. The most difficult questions of all were 53, "how far is a line usually produced in auxiliary construction," and 28, "state the converse of the proposition the diagonals of a rectangle are equal." The first of these had only 5.6 per cent. correct answers and the second 7.5 per cent. Questions 51, "What is the locus of the vertex of the right angle C of a right triangle constructed upon a given

SHOWING MADE BY DIFFERENT HIGH SCHOOLS FOR COMPLETE TEST OF 10 QUESTIONS

SCHOOLS	APPLS
—	A (102)
- - -	B (95)
- - -	C (86)
+	D (59)

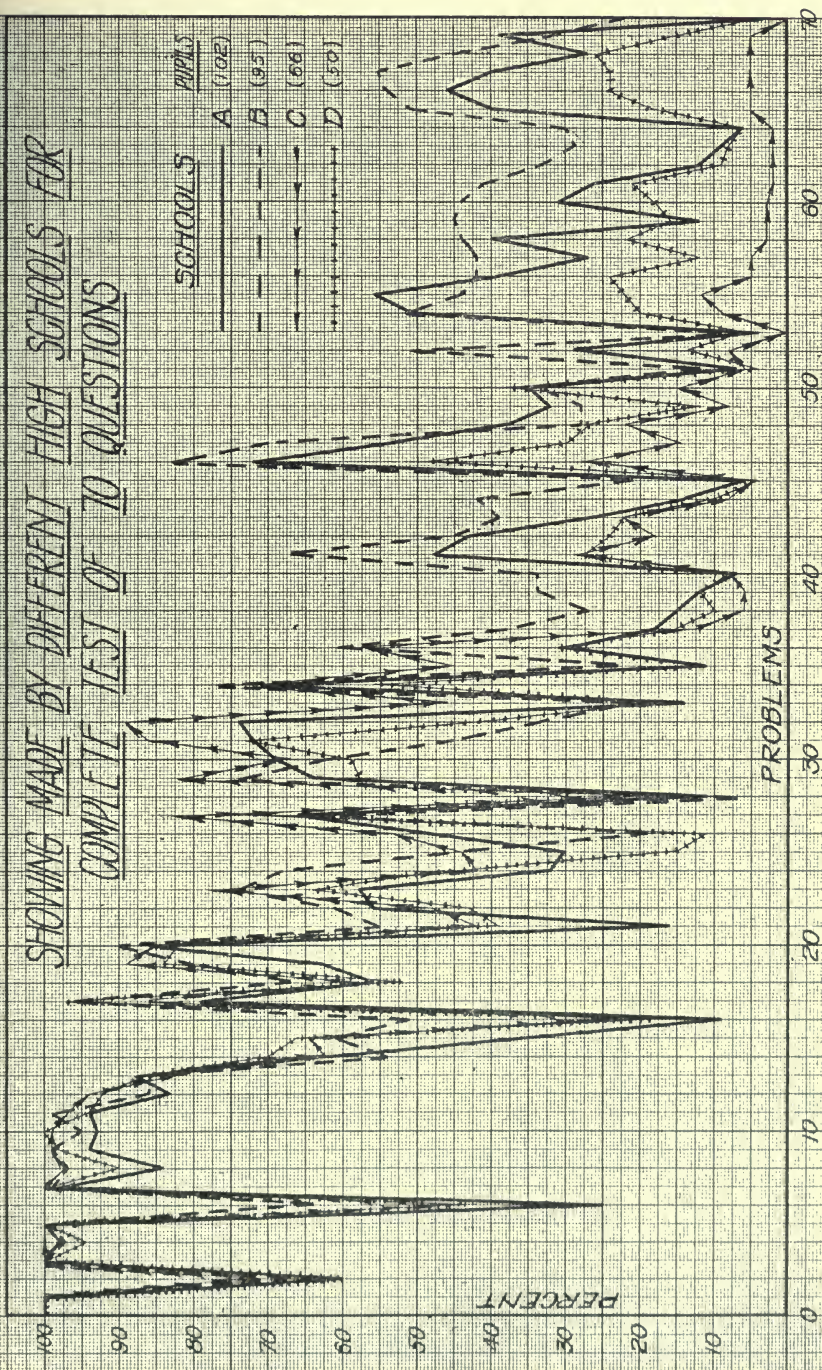


FIGURE I

hypotenuse AB," 45, the angle formed by intersecting chords, 33, outlining the steps in an indirect proof, 35, "What is the angle whose supplement is three times its complement," and 70, the steps to construct a square equivalent to any given polygon, were also difficult.

Figure II represents the comparative scores made by boys and girls, considering the total number of pupils from the high schools and the normal school, and plotting the values for numbered groups of problems instead of for separate questions. The close proximity of the curves seems to indicate that geometry abilities in boys and girls are about equal. Only in groups VII, IX, X, and XII do we find an appreciable difference. In general the boys are slightly in the ascendancy, being surpassed by the girls only in groups X, XIII, XVIII and XIX.

In Figure III are shown the results from two classes of girls, one the high 10 the other the low 11. Both had had the regular work in plane geometry in high 9 and low 10, and both were taking more mathematics, the high 10's solid geometry and the low 11's trigonometry. The low 11's are the smaller and more highly selected group, all of them taking mathematics because they like it. Yet they are by no means uniformly superior in these tests. Their chief superiority is found in groups V and VII, while in the hardest group, XI, they fall far below their younger sisters.

From Figure IV it will be seen that there are marked differences in the per cent. of pupils continuing in the test, or rather in the number of pupils attempting the later problems. Schools A and B, the largest of those tested, kept very close together, and a fairly large percentage of the pupils attempted all the problems. Many pupils in school D were able to attempt only 30 to 35 problems in the 40 minutes, while school C dropped still lower and had no pupil who attempted all the problems in the time. It is noteworthy that school C has the highest "efficiency," as indicated in Figure VII, and from the average time indicated on the papers it would seem that the time was cut short for some reason.

Figure V enables us to compare several groups of boys and girls at varying distances from their work in plane geometry. Of two groups of girls those who have had the plane geometry most recently make the higher score. The preliminary test

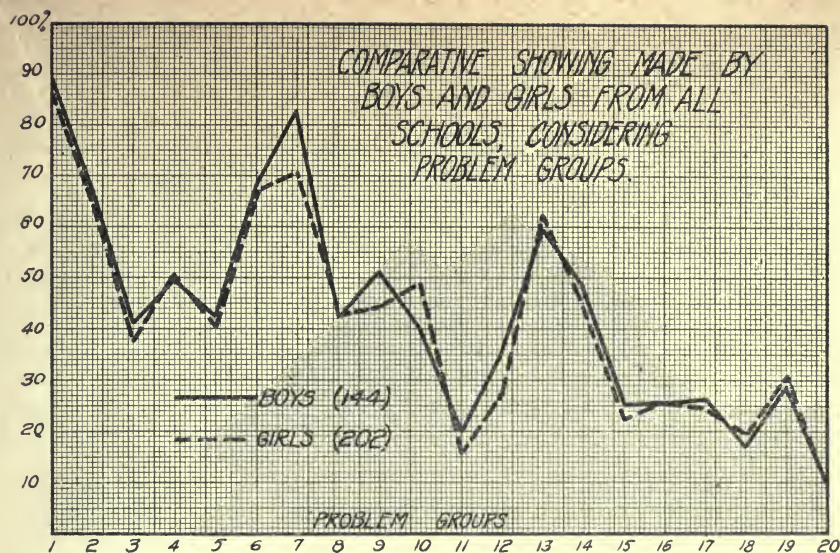


FIGURE II

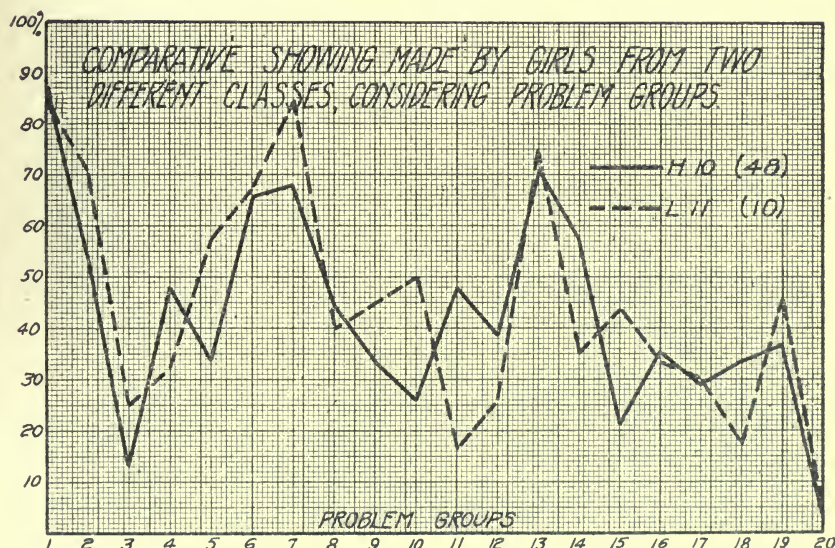
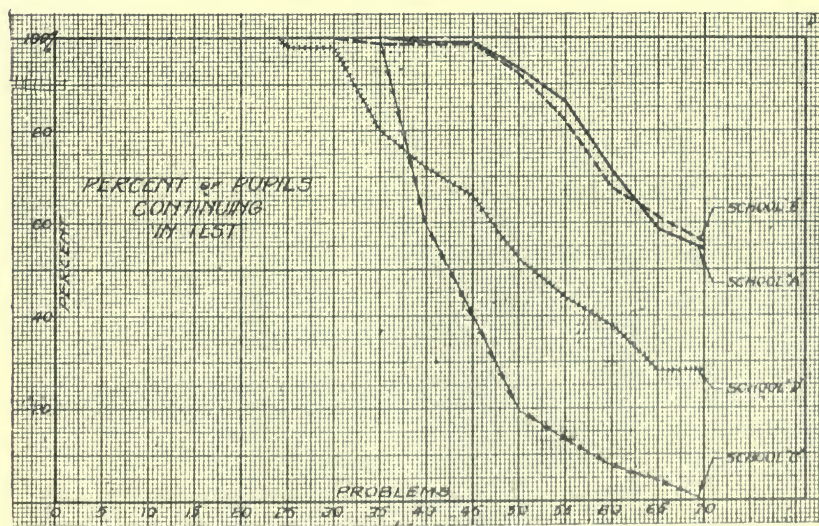


FIGURE III



VARIATION IN PERCENT OF PROBLEMS ANSWERED
CORRECTLY DUE TO TIME INTERVAL AFTER COM-
PLETING GEOMETRY AND TO SUBSEQUENT
MATHEMATICS COURSES TAKEN.

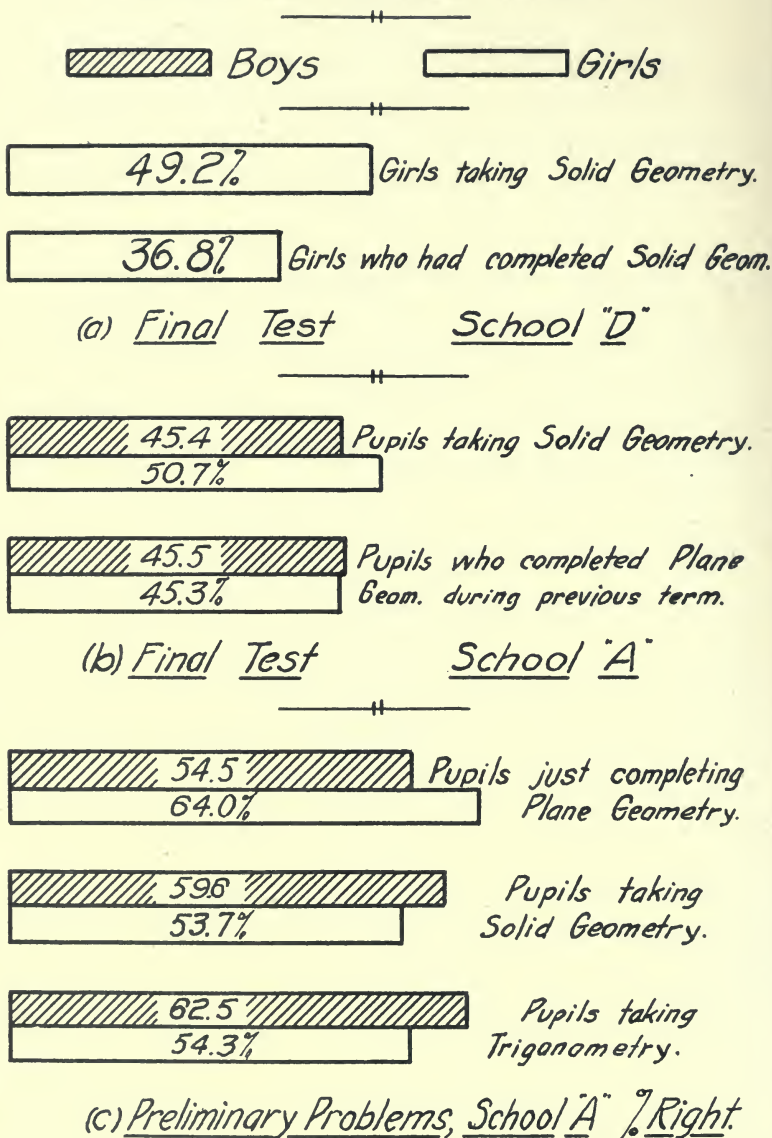


FIGURE V

(see bottom of Figure V) seemed to point to the conclusion that immediately on finishing plane geometry the girls made the higher score, but as more and more time elapsed the boys took the lead and increased it. This suggested the generalization that the girls worked harder and could give a better account of themselves while studying the subject, but either because of less real insight into the meaning of geometry or less permanent interest in it their attainments deteriorated more rapidly with the lapse of time. In the final test in that same school, however, the relation is reversed, the boys doing a trifle better in the group that completed plane geometry during the previous term, and the girls doing markedly better in the group taking solid geometry. The settlement of this question, therefore, awaits further investigation.

Figure VI presents the test scores of twenty pupils chosen at random from two classes and their class grades in plane geometry and in advanced algebra. The test scores were arranged in descending order, and the class grades plotted accordingly. In general there is a close resemblance between the test curve and the geometry grade curve. The test curve drops a little more rapidly than the grade curve, but this is doubtless due to the fact that a teacher's grades tend to be buoyed up at the lower end by the consciousness of 75 as the passing mark.

Figure VII gives the per cent. attempted, the per cent. right, the per cent. wrong, and the per cent. "efficient" of each of the four high schools.

To any subsequent workers in this field the authors would suggest that it might be advantageous to restrict the number of questions so that all taking the test may be able to attempt every question; that it would be well to note the time each one takes on the test in order to determine whether the rapid workers are also the most accurate; and that each pupil be asked to write out a complete record of his work in mathematics in order to furnish material for a more thorough-going evaluation of the results.

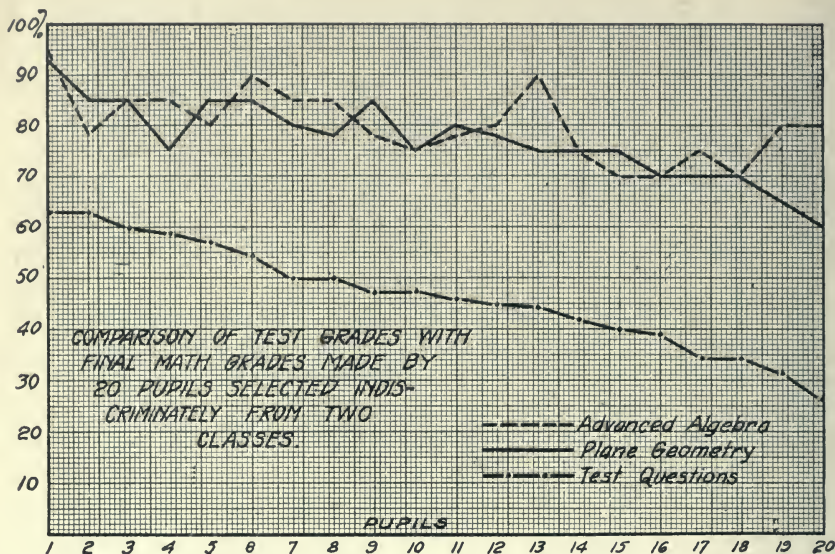


FIGURE VI

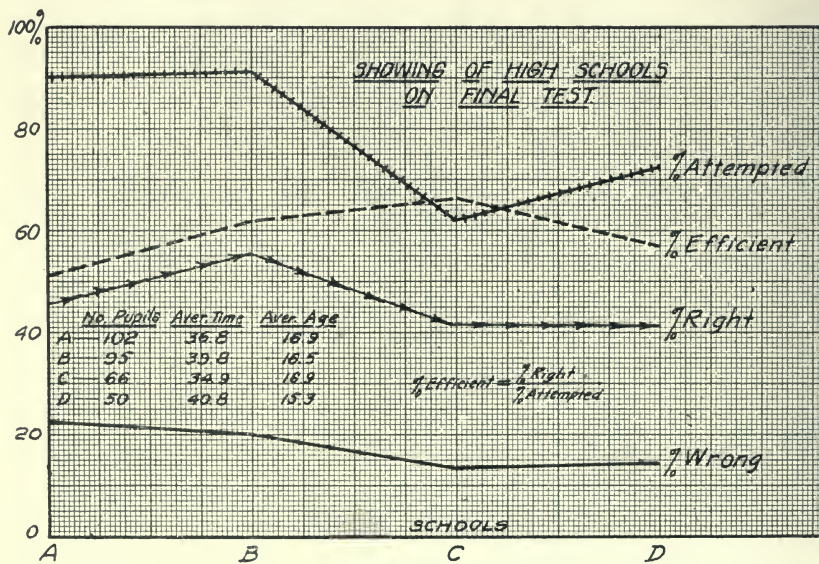


FIGURE VII

A SURVEY OF SPEECH DEFECTS

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During recent years, there has been an increasing interest in the problem of speech defects in school children. The newly organized speech clinic of New York City, the speech improvement work in the schools of Wisconsin and other states, the notable survey of 89,057 children in the St. Louis schools under the direction of Dr. J. E. Wallace Wallin, show how seriously this matter of speech defects is being considered. With the hope of adding some new light to this subject, a personal survey was undertaken by myself, assisted by Erminie Ballard and Margaret Gray Blanton, of all the children below the high school grade in the public and parochial schools of Madison, Wisconsin.¹ Madison has a population of about 30,000, and may be considered a typical American city of the middle West, so the figures gathered will probably hold true of other cities. The aim of the survey was to make a careful first hand study of the speech defects found in the schools, and to compare the results with those gained by the questionnaire.

METHOD OF PROCEDURE

A blank was used, whereon was recorded the name, age, and grade of each child with a speech defect. By comparing the age of the child with the grade, it was possible to tell if the child was retarded. The speech defects were classified under three heads: Stuttering, lisping and miscellaneous; a further sub-division under each head of mild, medium, and severe, was used. It is not possible to make distinction between mild, medium, and severe with scientific accuracy; the distinction was a rough one and depended largely upon the experience of the observer.

Stuttering, which includes stammering, was used to designate a speech defect that can be defined as a psycho-neurosis, of which the most obvious signs are continuous or interrupted spasms of the organs of respiration, phonation, or articulation. The mind is usually dominated during the symptoms by the emotion of fear. Ordinary hesitations and repetitions in reading, choreic

¹ I wish to thank Supt. Dudgeon and Father Conway, through whose kind co-operation the survey of the Madison public schools and the parochial schools was made possible. Thanks are also due to Dr. J. A. Bancroft, who made the impressions for the cuts used in this article.

movements, ties of the face during speaking, were not included under this head. Under the heading lipping were placed all those cases that definitely gave the wrong sound for the consonants s, z, t, and th. Age and dentition were taken into consideration. Under miscellaneous were included five groups: thick speech, indistinct speech, aphasia, mutism, and nasality. Thick speech is the type of defect found in children who have poorly developed tongues caused often by rickets or lack of thyroid extract, resulting in cretinism, or those who have a defective nervous system and are unable to make the fine coordinations necessary for correct speech. The "feeble-minded" have chiefly this kind of speech defect. Indistinct speech occurs in those who continue to use the slurring, indistinct speech of babyhood after they have reached school age. Examples will be given presently. Only cases of motor aphasia were considered. Motor aphasia in this case may be defined as the inability to use spoken language when there is no injury or destruction of peripheral nerves that govern the speech mechanism. By mutism is meant a defect in which the child, due to inhibitions or mental conflicts, refuses to, or is unable to, speak in school or with strangers, but is able to talk normally with certain persons, usually members of his own family. All cases grouped under nasality had cleft palates, either the hard or soft palate, or both. No case of any type of defect was included unless it was so marked that it could be recognized even by the casual observer. Slight slurs on the s and z sounds, ordinary nasal voice, or cases of slovenly speech were not considered. The cases of defects discovered in the classroom were referred to the teacher, and unless she agreed that the condition was severe enough to be called a speech defect, they were not included.

From kindergarten to fourth grade, the test used was some Mother Goose rhyme. After it had been ascertained that the children were familiar with the rhyme, each was asked to repeat it, saying it as well as he could. From the fourth through the eighth grade, this sentence was used: "The quick, red fox jumped over the simple, lazy dog." This was repeated several times until all the children with normal intelligence had memorized it. After a speech defect was discovered in this way, further tests were given to more clearly distinguish it. Those who seemed to have a lisp were asked to say the Mother Goose rhyme "Simple Simon met a pie-man" or "Simple Simon sold silks." For thick

and indistinct speech, various words and combinations of letters were given. Tests were given to determine aphasia, and some of those appearing very dull were given the Binet-Simon and the Knox-Healy mental tests. The speech of each child suspected of stuttering was further tested by reading and conversation. Finally, the mouth of each child was examined for the shape and formation of the hard and soft palate, for the shape of the jaw, and the occlusion of the teeth.

RESULTS OBTAINED

Seventeen schools were visited, twelve public and five parochial, and the number of pupils examined was four thousand eight hundred and sixty-two, ranging in age from four to eighteen years. Twenty-four of these were in special classes, but the children were recorded as being in the grade corresponding to the grade of work they were doing.

TABLE I.

	Stutterers	Lispers	Miscellaneous				
			Indist.	Thick	Nasal	Mutism	Aphasia
Female.....	8	69	19	1	2	0	2
Male.....	27	90	49	5	3	2	0
Totals.....	35	159	68	6	5	2	2
							277

From Table I can be seen the total number of speech defects, the number of each type of defect, and the distribution among the males and females. The percentages are as follows:

Total number of speech defects.....	5.69
Stutterers.....	.72
Lispers.....	3.27
Miscellaneous.....	1.71

The percentage of total number of speech defects is about twice as large as the 2.46% found by Conradi in 1904 in a survey of 87,440 children in Kansas City, Milwaukee, Cleveland, Louisville, Albany, and Springfield, Mass.,² and as the 2.8% found by Wallin in a survey made in October, 1915, of 89,057 children in the St. Louis schools.³ The percentage of stutterers, .72, is practically the same as that found by Wallin, .7, but the percentage of lispers and miscellaneous defects is about three times as large. Wallin's percentages are lispers, 1.6, miscellaneous, .4. This difference is due, I think, to the fact that the figures were gathered in the St. Louis survey by means of the questionnaire,

² CONRADI. *Speech Development in the Child*. Ped. Sem. Vol. 11, p. 365.

³ WALLIN. *A Census of Speech Defects*. School & Society, Feb. 5, 1916.

and many of the cases of thick and indistinct speech and cases of lisping were not reported by the class teacher, not accustomed to classifying speech defects. It should be remembered that in the present survey in order to avoid the criticism that cases were called speech defects that were merely cases of poor enunciation, no case was recorded unless the class teacher agreed that the child in question had a definite speech defect.

Table I shows the usual relationship of three males to one female stutterer. It also shows a decidedly smaller number of cases of lisping and miscellaneous speech defects among the females than among the males.

Table II shows the great number of deformities of jaw and teeth found, a total number of protruding and retracted jaws of 99, or 35.7%. Some of the jaw conditions are illustrated by the cuts shown on another page. There were many more cases of enlarged adenoids and tonsils than were reported, but as a thorough physical examination of the throat and nose could not be made and the records of the examining physician could not be easily obtained, only six cases were recorded. The large number, 49 or 17.7%, of retarded children found among those with speech defects is significant. The cases were called retarded that were two or more years behind their grade, without adequate explanation. About ten of these were feeble-minded children whose

TABLE II.

	Sum Total	Male	Female	Mild	Medium	Severe	P. L. J.	R. L. J.	Tonsils and Adenoids	Retarded
I.....	26	15	11	5	13	8	12	3	1	4
II.....	15	10	5	9	5	1	1	3	0	3
III.....	18	11	7	10	7	1	0	3	0	2
IV.....	12	4	8	5	5	2	0	1	1	0
V.....	5	3	2	1	2	2	0	0	0	0
VI.....	12	9	3	3	6	2	0	0	0	0
VII.....	24	18	6	9	13	2	2	0	1	4
VIII.....	14	12	2	3	7	4	7	0	0	2
IX.....	36	21	15	15	12	9	15	11	2	8
X.....	30	17	13	16	7	7	10	4	0	8
XI.....	18	11	7	10	4	4	3	6	0	0
XII.....	35	28	7	18	8	9	7	4	0	12
XIII.....	4	1	3	0	4	0	0	0	1	1
XIV.....	15	10	5	1	8	6	1	2	0	1
XV.....	6	3	3	1	4	1	0	0	0	1
XVI.....	7	3	4	1	6	0	1	1	0	3
Totals.....	277	176	101	107	111	59	61	38	6	49

speech defect was due to the lack of brain development. We felt, however, that a great majority were retarded *because of the speech defect*, and in a number of these cases, the class teacher declared that it was the sole cause of the backwardness. There can be no doubt that speech defects, especially stuttering, cause backwardness in the school work of otherwise normal children.

Table III shows the different types and the total number of speech defects in each grade. It is seen that the number of defects is greatest in the first grade and gradually diminishes until, when the eighth grade is reached, they have practically disappeared. The curve shows this graphically. A great many children get over their speech defects, that is, they are able to speak without a noticeable defect, but there remains, in practically every case of lisping and thick and indistinct speech, a poor articulation, a slovenly condition of the speech that is so common. Many children are so retarded in their school work by their speech defect that they drop out as soon as they reach the age when the law allows them to stop school, and many children who acquire a speech defect at pubescence get discouraged and drop out. Most of these cases drop out about the fifth grade. In the case of the stutterers, even though the symptom be recovered from, there remains in many cases the original mental conflict, the lack of adjustment that causes other neurotic symptoms beside stuttering.

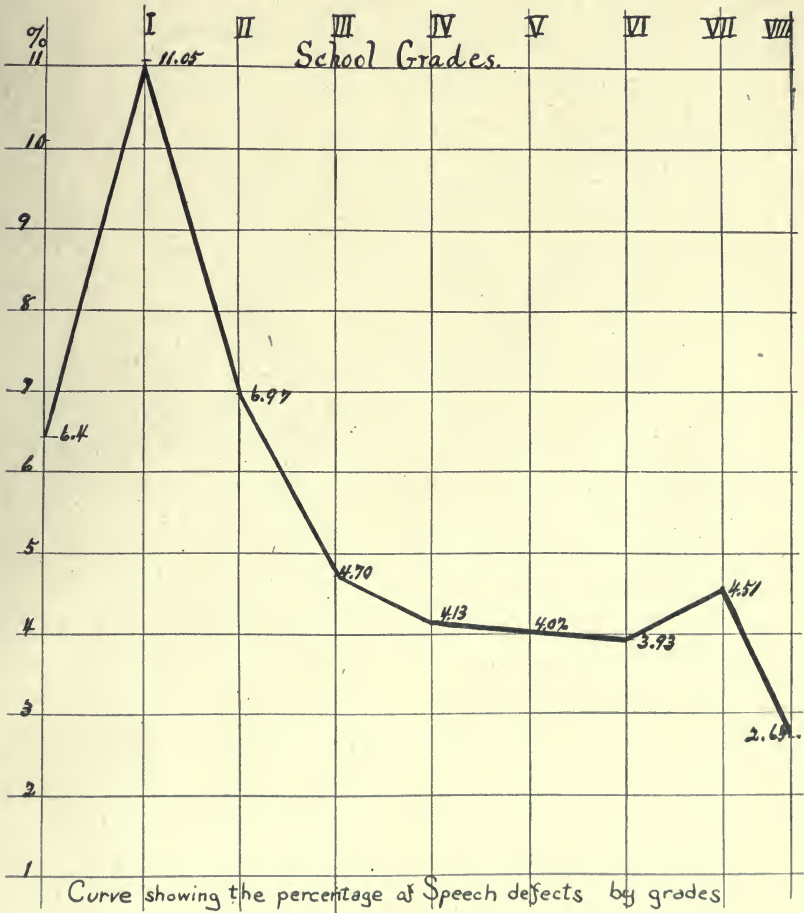
The most significant points on the chart are the kindergarten, 6.4 per cent., first grade, 11.05 per cent., and the seventh grade, 4.51 per cent. Experience shows that the children in the kindergarten who have speech defects acquired them at the beginning of speech development. The increased percentage in the first grade may be attributed to four causes:

1. The beginning of formal study.
2. The breaking of home associations.
3. The change in dentition.
4. The study of reading.

In the beginning of formal study, the nervous child is made more nervous, the sufferer from malnutrition and the sickly child are put on a still further strain, all of which is likely to cause or aggravate cases of stuttering or neurotic lisping. The breaking of home association may cause mental conflicts that affect the speech mechanism. The change in dentition: in order to make the proper sound of s and z, the teeth must be closed, and when

TABLE III
Speech Defects. First 8 Grades and Kindergarten

By Grades		Stutterers				Lisping				Indistinct				Thick				Nasal				Mutism				Aphasia				Percentages	Totals
		Mi.	Me.	Se.	Total	Mi.	Me.	Se.	Total	Mi.	Me.	Se.	Total	Mi.	Me.	Se.	Total	Mi.	Me.	Se.	Total	Mi.	Me.	Se.	Total						
K	M.....	0	0	1	1	1	5	0	6	5	2	2	9					0	0	1	1					6.4	179 26				
	F.....	0	0	0	0	3	2	0	5	1	0	3	4					0	0	0	0										
	Total...	0	0	1	1	4	7	0	11	6	2	5	13					0	0	1	1										
I	M.....	2	0	0	2	7	12	5	24	5	5	6	16	0	1	0	1	0	0	1	1	0	0	1	1	11.05	45 80				
	F.....	0	0	0	0	10	10	2	22	2	4	3	9	0	1	0	1	0	0	0	0	0	0	0	0						
	Total...	2	0	0	2	17	22	7	46	7	9	9	25	0	2	0	2	0	0	1	1	0	0	1	1						
II	M.....	2	1	1	4	6	8	4	18	2	5	2	9	1	0	0	1									6.97	32 13 45				
	F.....	0	0	0	0	4	3	4	11	0	2	0	2	0	0	0	0														
	Total...	2	1	1	4	10	11	8	29	2	7	2	11	1	0	0	1														
III	M.....	1	0	0	1	3	8	2	13	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	4.70	17 12 29				
	F.....	1	0	0	1	5	3	0	8	0	1	1	2	0	0	0	0	0	0	1	1	0	1	1							
	Total...	2	0	0	2	8	11	2	21	0	2	1	3	0	1	0	1	0	1	1	2										
IV	M.....	2	1	0	3	5	7	0	12	2	1	0	3	1	0	0	1									4.13	19 6 25				
	F.....	1	0	0	1	3	2	0	5	0	0	0	0	0	0	0	0														
	Total...	3	1	0	4	8	9	0	17	2	1	0	3	1	0	0	1														
V	M.....	3	2	0	5	0	3	2	5	1	2	2	5	0	1	0	1									4.02	16 6 22				
	F.....	2	0	0	2	1	2	0	3	0	1	0	1	0	0	0	0														
	Total...	5	2	0	7	1	5	2	8	1	3	2	6	0	1	0	1														
VI	M.....	4	0	1	5	3	1	2	6	0	2	0	2													3.93	13 7 20				
	F.....	1	0	0	1	2	3	1	6	0	0	0	0																		
	Total...	5	0	1	6	5	4	3	12	0	2	0	2																		
VII	M.....	0	0	3	3	2	1	1	4	0	3	0	3					0	0	0	0					4.51	10 9 19				
	F.....	0	1	1	2	3	1	1	5	0	1	0	1					0	0	1	1										
	Total...	0	1	4	5	5	2	2	9	0	4	0	4					0	0	1	1										
VIII	M.....	1	1	0	2	1	0	0	1	1	0	0	1					0	0	1	1					2.65	5 4 9				
	F.....	1	0	0	1	3	0	0	3	0	0	0	0					0	0	0	0										
	Total...	2	1	0	3	4	0	0	4	1	0	0	1					0	0	1	1										
Male.....		27				90				49				5				3				2				0				176	
Female.....		8				69				19				1				2				0				2				101	
Total.....		35				159				68				6				5				2				2				277	



the front teeth are absent, there is a slurring of these sounds. The speech habits formed at this time are in some cases carried over into later years. In this survey, no child was counted as having a speech defect who lisped because of absence of the front teeth. In reading, different phrasing and breathing are necessary for the potential stutterer. The increased percentage of defects in the seventh grade is due to the influence of puberty, instability of the nervous system, and mental conflicts. The sharp decline between the seventh and eighth grades is caused by the dropping out of school, by a relatively great per cent. of unfit children. As has been mentioned, many of the cases drop out before the seventh grade. But if all the cases of speech defects in the first grade remained in school until the seventh grade, the percentage would be astonishingly higher in this grade.

The thirty-five cases of stuttering ranged in severity all the way from a slight hesitation to a condition where there were severe spasms of the face and body, as well as the muscles of the speech mechanism. Some interesting facts were discovered by a thorough study of fifteen of these stuttering cases.

1. In one-third of the fifteen cases studied heredity played a part in the etiology, as it was found in five cases that one of the parents stuttered or had stuttered.

2. Another third of these cases seemed to be developed by some specific shock, which gave rise to some mental condition. H. S. is a good illustration. He is a Russian Jew thirteen years and two months old. At the age of nine years, he was struck and abused by a boy some years older than himself. He seemed to become troubled and less cheerful after this, and shortly he began to stutter. He is a severe stutterer, and has an unusual tic when talking that takes the form of a rhythmic swaying of his body backward and forward when he tries to talk. The association test and psycho-analyses are being used to determine the mental conflict that causes his symptoms.

3. The third five were caused by some mental conflict arising in relation to the child's home or school conditions. T. M. is an Italian boy of nine years, and illustrates how conflicts causing speech defects arise in relationship of the child to his school. He spoke only Italian when he started to school, and when he tried to speak English, he began to stutter. There are other elements in this case, but the language conflict seems to be the chief etiological cause.

The average age at which stuttering began was six years. At least ten of the cases studied are decided neurotics, and unless given treatment, will become chronic neurotics and social failures. It is this fact that should be emphasized, that the stuttering child is suffering from a neurosis, and in most cases, unless treatment is given, he will become a social failure.

Lisping is the most frequent of all the speech defects. It may be divided into three types; simple, neurotic, and organic. Simple lisping arises because of carelessness, or during the period between the loss of the first teeth and the eruption of the permanent teeth. Phonetic drills are sufficient to cure the simple lisp.

In the neurotic lisp, there exists such a nervous condition that the child is unable to use the speech mechanism properly, and the tongue is not placed in the right position for making the s sound. Good hygiene, as well as phonetic drills, is needed here in order to eliminate the defect. In the case of organic lisping, there is some abnormality of the teeth or jaws or palate. If there is a marked protrusion of the lower jaw, so that the lower teeth come in front of the upper when the jaws are closed, lisping or imperfect speech is sure to result. And the same is likely to occur if the upper teeth protrude too far in front of the lower. These deformities are often caused by thumb sucking and the use of the pacifier. The following six pictures illustrate the different types of deformities found in lisping children. Such children require the care of the oral surgeon before they can speak correctly.

The case of S. M. illustrates a type of indistinct speech. S. is 7 years, 4 months of age. When she entered kindergarten at the age of five, she made only inarticulated sounds. She had poor ability in hand work, and was awkward in her movements, often falling down when attempting to run and skip with the other children. She is now in the first grade, but will not pass this year. For the past three months, she has been given work in corrective phonetics. When we began this training, her speech was absolutely unintelligible, but it had improved 100% by June. Even yet, her speech is quite imperfect. When asked to say Mother Goose rhyme:

“Jack and Jill
Went up the hill
To fetch a pail of water;
Jack fell down
And broke his crown,
And Jill came tumbling after.”

Picture No. 1

Medium Lisp Age: 12 yrs. 2 mos. Fifth Grade

This case had enlarged adenoids and tonsils and as a result has a high, narrow arch. The upper jaw is pointed and protruding. Because of the high narrow arch of the hard palate and the retracted lower jaw, the child has difficulty in raising the tongue to the roof of his mouth, so as to take the correct position in making the sound s.

Picture No. 2

This is the arch of the hard palate of the impression shown in picture No. 1.

Picture No. 3.

Medium Lisp Age: 13 yrs. 2 mos. Fourth Grade

This child is backward, repeated first and second grades. She was late in learning to talk, and at the age of seven could not speak distinctly. Beside a slight retraction of the lower jaw, there is a backward tilt of the lower teeth. The lisp occurs almost exclusively on the s sounds.

Picture No. 4

Severe Lisp Age: 13 yrs. Fifth Grade

In this boy, there is such an irregularity of the teeth that they do not meet, and hence the sound of s cannot be properly made.

Picture No. 5

Mild Lisp Age: 6 yrs., 11 mos. First Grade

In this case, the occlusion of the teeth is about normal, but the teeth are very irregular. Th is substituted for the s sound.

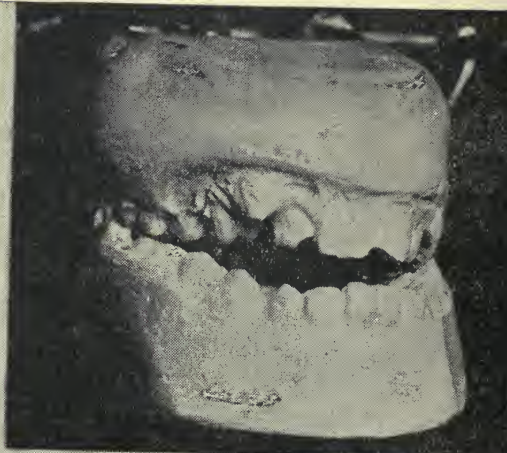
Picture Nb. 6

Medium Lisp Age: 9 yrs. 2 mos. Fourth Grade

This little girl was without front teeth for about six months and at this time the lisping began. There is a protrusion of the lower jaw, and the upper teeth are large and uneven. The lisp is chiefly on the s sound.



#1



#4



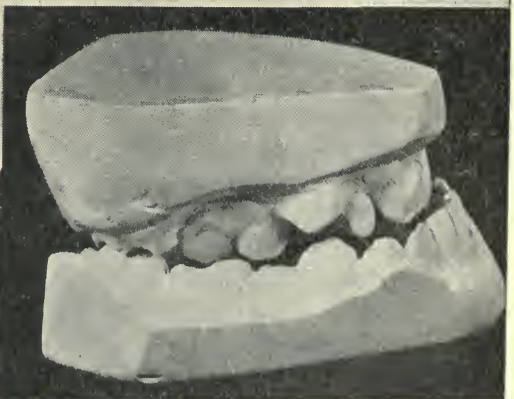
#2



#5



#3



#6

she said it this way:

“Da er De
Weh er o Hill
To feh er pa er wotty;
Da feh dow
And boke he pow
De ta tuddy atte.”

From an analysis of this phonetic representation of the speech of S., we can see that she did not make the j sound, nor the p, t, ch, n, r, and f sounds. Without speech training, this child would probably become more and more retarded and possibly never get out of the high grade moron class. In this, as in other cases, the speech defect was only a symptom of a wide-spread condition. There was lack of motor co-ordination in the hands and legs, becoming more marked in the fine muscles of the speech mechanism. Speech training in such cases is not only needful to improve the speech, but it stimulates the growth of the brain cells in quite a direct way. Of course, general motor education was given, as well, for its effect on the speech mechanism.

The conclusions to be drawn from this study of children with defects of speech are, we believe:

1. There are five per cent. of school children, more than are given in most surveys, suffering from speech defects.
2. Speech defects relate themselves to the problem of the feeble-minded and retarded children, and also to those who have some neurotic trait that disqualifies them from adjusting themselves to the school routine.
3. There should be special teachers appointed to treat the children with speech defects. Courses in speech training should be given in the kindergarten and first and second grade, where most of the speech defects begin, and by such a training, mild cases of speech defects could be cured, and many defects could be prevented altogether. The special teachers should have more than a training in phonetics or public speaking or elocution. They should know the anatomy and physiology of the speech mechanism, and know something of abnormal psychology and the principles of psycho-analysis. Teachers so trained are needed in a majority of the school systems of this country.

METHODS OF EXPRESSING RESULTS OF MEASUREMENTS OF INTELLIGENCE: COEFFICIENT OF INTELLIGENCE¹

ROBERT M. YERKES AND LOUISE WOOD

Ordinarily, it is not very difficult to devise means of expressing the results of simple mental, social, or physical measurements. But it appears that the sort of measurements which result from the application of scales for measuring intelligence are not readily expressible in strictly comparable terms. For several years, group measurements of intelligence have been made by the Binet and other scales, and various means have been employed for expressing the general results. But the modes of expression have varied extremely in convenience, reliability, and comparability. It is evident that at present there is no generally understood and commonly accepted statistical datum for such measurements.

Of the several modes of expressing intellectual status, the following are most commonly used: (a) mental age; (b) age-difference (retardation or acceleration); (c) frequency, or order of rank; (d) deviation from the median, mean, or normal value; (e) intelligence quotient (sometimes improperly designated as mental quotient); (f) coefficient of intelligence.

As a preliminary to our consideration of certain data concerning the coefficient of intelligence, we shall review the important characteristics of these six modes of statement.

(a) *Mental Age*. From the practical point of view, this seems the simplest and most natural way of expressing intellectual status, but its apparent simplicity is misleading and its practical value tends to be overestimated. For, in the first place, although it is commonly assumed that the statement "mental age of ten years" (more strictly, intellectual age) has very definite meaning for most of us, inquiry indicates that it does not, and further that even reasonably experienced psychologists, psychological examiners, teachers, and parents have widely varying conceptions of the intellectual ability of the average ten-year-old boy or girl. Again, mental or intellectual age gains significance only through comparison with another age value for the individual. Most commonly used for this comparison is the so-called chronological age, or period since birth. Inasmuch, however, as rate of growth and time of maturing vary considerably in individuals, it is clear that chronological age is not a safe basis for prediction of intellectual status. Instead, what may appropriately be termed physiological age should be used. This, like the intellectual age, must be determined by carefully selected measurements.

It is then clear that mental age alone lacks practical value, that it gains value when viewed in relation to physiological age. It is therefore necessary to employ

¹ Being Contribution of the Mass. Commission on Mental Diseases, whole number 155, 1916. 13. The previous contribution (154, 1916. 12) was by E. E. SOUTHARD, entitled "*The Psychopathic Hospital's Function of Early Intensive Service for Persons not Legally Insane*," to appear in Proceedings of the National Conference of Charities and Correction, 1916.

either instead of, or in addition to, the value mental age an expression of the relation of mental age to physiological age. This has been done in many cases by determining the difference between the two ages. The statistical datum thus obtained may well be termed age-difference. Actually, age-difference has not been used alone in descriptions of intelligence measurements, but since it evidently might be, we shall consider it below as mode (b) of expressing results of measurements of intelligence.

(b) *Age-difference*. As has already been stated, the difference between mental age and chronological age is misleading because of individual variations in growth. But even when physiological age is used instead of chronological age, a serious objection to age-difference as an index of intelligence may be offered. For the value of a given period, say a year, of mental development varies with age. The amount of intellectual development occurring in one year during early childhood is equal to that which occurs in two years during late childhood or during four or five years during adolescence. Otherwise expressed, since the significance of the chronological unit of development varies, that unit cannot be used alone as a means of expressing intellectual status.

(c) *Frequency Order of Rank*. It is obviously serviceable to know the relative value or rank-order of a given individual's intellect. Such a value might be known as intelligence frequency, relative intelligence, or simply rank. It has the advantage of indicating what may reasonably be expected of an individual in comparison with his fellows. One way to express frequency is in terms of the percentage of occurrence of a given order of intellect. Miner² has recently advocated the use of this device as a means of defining intellectual deficiency. Examiners would necessarily make use of statistical tables or curves of the distribution of intelligence in evaluating individual measurements.

Frequency of occurrence is unquestionably a useful datum, which should be presented, if not instead of, then in addition to, certain other statistical indices which possess greater scientific value.

(d) *Deviation*. It is possible, and it may ultimately prove highly desirable, to employ some form of deviation-value as a measure of intellectual status. Either the average or the standard deviation may be thus used. But it remains to be seen whether such values are in any respects superior to the ratios which are discussed below.

(e) *Intelligence Quotient*. The intelligence quotient, although less widely employed by psychological examiners than mental age or age-difference, has very important advantages. These have been appreciated by those investigators who considered seriously the statistical aspects of description. Prominent among the advocates of this mode of expression are Stern,³ Bobertag,⁴ Kuhlmann,⁵ and Terman.⁶ The intelligence quotient is the ratio of mental age to chronological age. It has been used repeatedly in connection with Binet measurements, and it should be understood that its value varies extremely with the form of the Binet method which happens to be employed. This accounts for certain adverse criticisms of the mode of expression.⁷

From what has been said, it is apparent that the intelligence quotient is the natural way of avoiding important defects of mental age and age-difference. The reliability of the quotient depends upon several variable factors, important among which are the accuracy of the measurements of intelligence and the trustworthiness of chronological age.

² MINER, J. B. *A Percentage Definition of Intellectual Deficiency*. The Psychological Bulletin, 1916, 13, 89.

³ STERN, WILLIAM. *The Psychological Methods of Testing Intelligence* (English translation). Baltimore, 1914, 36-42.

⁴ BOBERTAG, O. *Ueber Intelligenzprüfungen*. Zeitschrift für angewandte Psychologie, 1912, 6, 531.

⁵ KUHLMANN, F. *Journal of Psycho-Asthenics*, 1913, 17, 132.

⁶ TERMAN, L. *The measurement of intelligence*. Boston, 1916, 65.

⁷ DOLL, E. A. *Note on the intelligence quotient*. The Training School Bulletin, 1916, 13.

Stern claims that the value of the intelligence quotient tends to diminish with age. Terman maintains, in the light of data yielded by the Stanford revision of the Binet method, that it is practically constant.

It is our impression that for the expression of Binet results nothing comparable in statistical value to the intelligence quotient has been suggested, but it should be added that the reliability of the quotient will necessarily vary with the method of measurement. The Stanford Revision of the Binet scale promises to yield more accurate measurements of intellectual status, and consequently more reliable intelligence quotients than does the original or any other modification of the Binet scale.

(f) *Coefficient of Intelligence.* The same in principle as the intelligence quotient of the Binet method is the coefficient of intelligence of the point-scale method. This value has been termed coefficient instead of quotient because it is not directly comparable with the Binet quotient. Were we to speak of it as an intelligence quotient, confusion would result, and from overhasty or thoughtless critics would come ill-founded objections.

The coefficient of intelligence is definable as the ratio of an individual's point-scale score to the expected score, or norm. As in the case of the intelligence quotient, the coefficient may be expressed as a fraction. Thus for I. Q. we have $\frac{7}{10}$ to indicate that a child of seven-year intelligence is chronologically ten years old, or in decimal form, the I. Q. reads .70. For the point scale, the fraction $\frac{20}{35}$ means that a child for whose age the expected score is 35 points obtains in examination only 20 points, or expressed as a decimal, the coefficient of intelligence for the individual is .57.

What has already been said of the importance of physiological age in connection with measurements of intelligence applies with equal force to the point-scale procedure. For it is clearly unfair to expect of an individual who is physically retarded because of malnutrition or overwork the mental age appropriate to his chronological age. We are in agreement with Crampton,⁸ who has presented and defended the thesis "physiological age should be taken as a basis for all records, investigation, pedagogical, social, or other treatment of children." And although we have not yet been able to present physiological age norms for use in connection with the point scale, we are fully convinced of their desirability and heartily welcome all efforts directed toward the development of serviceable methods of measuring physiological age.⁹

⁸ CRAMPTON, C. WARD. *Anatomical or Physiological Age versus Chronological Age.* The Pedagogical Seminary, 1908, 14:230.

⁹ BALDWIN, BIRD T. *A Measuring Scale for Physical Growth and Physiological Age.* The Fifteenth Year Book, Part I, National Society for the Study of Education, 1916, 11-22.

In the present stage of development of measurements of intelligence and of modes of dealing with them, it is highly desirable to determine, so far as possible, the practical and scientific value of the coefficient or quotient of intelligence. Kuhlmann, some years ago, clearly perceived the desirability of expressing degree of deficiency "by some mathematical relation of the mental and chronological ages." He has since argued most effectively for the use of the intelligence quotient in connection with Binet measurements. He further appreciated the importance of rate of mental development and the desirability of definite measurements thereof, but at that time he wrote, "We have at present no means of measuring this rate of progress and its changes."¹⁰ The measurements of which Kuhlmann felt the need, the point-scale method supplies. Indeed, at the time the above sentence was written by him, we were engaged, in the Psychopathic Hospital, Boston, in developing the point-scale method as a means of measuring the rate of intellectual growth and of determining individual intellectual status.

For the safe use of intelligence coefficients or quotients, it is essential to look well to the following fundamentals of method and information. (1) Reliable norms of judgment. For the point-scale method these should be physiological age-norms, by half years or smaller intervals. The Binet method also rests upon norms, but they are embodied in the structure of the scale and are usually spoken of as the standardization or age arrangement of tests. (2) Normal distribution or frequency of measurements and of resulting coefficients or quotients. Highly reliable distribution tables and curves must be made available if our measurements of intelligence in childhood or maturity are to be reliably expressed in terms which shall render comparison both convenient and safe. (3) Correction for physiological age where chronological or other age data are regularly employed.

We have been able to accumulate, during the past three years, upward of four thousand point-scale examinations. The data of these examinations bear so directly upon the important points which have been made with reference to modes of expressing intellectual status that we wish to present, briefly, the significant results for certain of our groups of measurements.

The total number of subjects for whom coefficients are presented below is twenty-four hundred and fourteen. These fall into the following six groups:

¹⁰ Journal of Psycho-Asthenics, 1913, 17, 136.

Pupils of Cambridge schools.....	829
Pupils of Iowa schools.....	166
Cincinnati 18-year old group.....	237
Massachusetts adult group.....	50
Ohio Industrial School group.....	997
Little Wanderer's Home group.....	135
	<hr/>
	2414

Of these examinations, twelve hundred and eighty-two constituted what we shall call the normal group; eleven hundred and thirty-two, the Ohio Industrial School group and the Little Wanderer's Home group, constitute a specially selected group which cannot be designated as normal.¹¹

The coefficients were determined by use of the intellectual norms offered in "*A Point Scale for Measuring Mental Ability*," page 66. For age 16—the norm 84 and for age 17—the norm 86 were used. For all except twenty-five of the individuals eighteen years of age or above, the norm 88 was used; for the excepted group, a special norm of 94. Since for some of the subjects whose examinations were reported to us, we knew the age only to the nearest year, all coefficients were calculated without reference to fractions of a year. This introduces a very large error for young children and one which is practically negligible for adults. We regret exceedingly that our coefficients could not have been determined on the basis of year and month age data for all subjects.

For the group of two hundred and thirty-seven eighteen-year-old children, the age-differences and the coefficients of intelligence are offered in Table I, and as another sample of these values, there appear in Table II the results for the group of one hundred and thirty-five individuals examined at the Little Wanderer's Home.

The distribution of coefficients for the twelve hundred and eighty-two subjects included in the public school groups, the eighteen-year-old group, and the Massachusetts adult group, appears in Table III. The most important facts of this distribution are, first, the diminishing range of coefficients with increasing age; and second, the relative uniformity of range for the years eight to thirteen. This table, in conjunction with our experience

¹¹ We wish to express our indebtedness and heartiest thanks to Professor R. H. Sylvester of the University of Iowa, to Doctor Helen Thompson Woolley of Cincinnati, to Doctor T. H. Haines of Columbus, and to Miss Rose S. Hardwick of the Little Wanderer's Home, Boston, for data from their respective localities or institutions.

TABLE I.

Age Differences and Coefficients of Intelligence for 18-year Group (237). Norm used 88. Average Score for Group 89+ (Woolley)

MALES				FEMALES			
No. of Cases	± Yrs.	No. of Coef.		No. of Cases	± Yrs.	No. of Coef.	
2	-8.8	.65		1	-9.9	.48	
4	-8.3	.68		1	-9.7	.51	
2	-8.2	.69		2	-9.0	.64	
1	-7.7	.72		2	-8.6	.66	
2	-7.5	.73		1	-8.3	.68	
2	-7.0	.74		1	-8.2	.69	
4	-6.9	.75		1	-8.0	.70	
1	-6.7	.77		3	-7.7	.72	
3	-6.6	.78		2	-7.5	.73	
3	-6.5	.80		1	-7.0	.74	
2	-6.5	.81		1	-6.9	.75	
2	-6.4	.82		3	-6.8	.76	
4	-6.3	.83		1	-6.7	.77	
6	-6.2	.84		3	-6.6	.78	
7	-6.1	.85		1	-6.5	.80	
2	-6.1	.86		1	-6.5	.81	
4	-6.0	.87		1	-6.4	.82	
7	-5.5	.89		3	-6.3	.83	
				3	-6.2	.84	
				5	-6.1	.85	
				3	-6.1	.86	

in using the point scale, convinces us that the original or pre-adolescent point scale, whose data alone are used in this paper, is not satisfactory for young children. It possesses maximal value for the ages seven or eight to twelve or thirteen; it is markedly unsatisfactory for the ages four and five; reasonably reliable for the ages six and seven, and above thirteen.

Terman has stated as an argument in favor of the intelligence quotient, that for his examinations the range of the quotients is practically constant from four years to fifteen years. We should not have predicted this constancy of range any more than we should have predicted for the coefficient of intelligence a marked decrease in range with increasing age. Evidently, however, the reliability of our coefficient and its value for purposes of comparison are conditioned by characteristics of range. It should be noted that precocity has much greater influence early than late in intellectual development. Indeed, our own data show that a few months' difference in age will alter the coefficient of a five or six year old child by ten to thirty per cent.; of the adult, by five to ten per cent. Table 3 makes it appear that extraordinary intellectual ability is fairly common up to eight years of age, and then becomes very uncommon.

TABLE II.
Age-Differences and Coefficients of Intelligence for Little Wanderers Home Group of 135 Children (Hardwick)

4 Years		5 Years		6 Years		7 Years		8 Years		9 Years		10 Years		11 Years		12 Years		13 Years		14 Years		15 Years		16 Years		17 Years		18 Years		19 Years		
± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.	Coef.	± Yrs.		
-2.0	.53	-4.0	.14	-4.9	.29	-4.1	.38	-8	.83	-2.9	.54	-2.3	.63	-9.2	.11	-8.8	.39	-6.9	.38	-5.3	.70	-4.2	.82	-6.7	.68	-7.5	.67	-9.0	.62	-6.5	.80	
-2.1	.55	-3.0	.44	-3.3	.39	-1.5	.73	-2	.91	-8	.67	-1.7	.69	-3.2	.61	-2.2	.79	-3.2	.92	-2.6	.87	-3.3	.85	-4.4	.73	+	.3	1.01	-7.1	.72	-6.4	.81
		-2.6	.45	-3.3	.44	-1.6	.73	-1	.96	-1.4	.69	-1.3	.82	-2.1	.85	-3.0	.79	-3.6	.78	-2.3	.90	-1.6	.90	-4.9	.79	+	.7	1.03	-7.0	.75	-4.0	.92
		-1.9	.57	-2.8	.46	-1.3	.76	-1	.98	-1.3	.77	-1.3	.89	-1.6	.88	-9	.89	-2.0	.82	-2.1	.90	-1.6	.99	-3.1	.93	+	.7	1.02	-6.7	.78	0	1.70
		-1.2	.71	-2.6	.51	-1.1	.81	+	1.33	-	.81	-1.5	.95	-1.5	.91	0	.99	-2.2	.83	-2.0	.95	+	1.05	-1.2	1.02	+	.7	1.05	-4.5	.90		
		-1.0	.77	-2.5	.53	-	.89	+	1.33	-	.81	-	.97	-2	.96	+1.8	1.02	-1.3	.91	-1.5	.98	+	1.05	-1.4	1.05	+	.2	1.01	+			
		+1.3	1.31	-1.3	.58	0	.97	+	1.33	+	.86	+	1.00	0	1.00	+3.5	1.12	-1.1	.92	-	.3	1.05	+	1.06	+	.3	1.06	+	1.11	+	1.15	+
				-1.3	.74	0	.90	+	1.00	+	.77	+	1.1	.5	1.09			1.8	.85	+	1.2	1.05	+	1.15	+	1.13	+	1.09	+	1.15	+	
				-1.0	.76	+	1.06	+	1.16	+	.90	+	2.0	1.21	+	1.10		1.8	.95	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
				+1.4	.77	+1.4	1.36			+	.94	+	2.0	1.21	+	1.13		2.5	1.08	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
				+1.5	1.33		1.45			+	.96	+	2.0	1.21	+	1.13		2.5	1.08	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
				+1.2	1.21					+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+	1.13	+	1.09	+	1.15	+	
										+	.98	+	2.0	1.21	+	1.13		4.4	1.23	+	2.2	1.10	+	1.15	+							

TABLE III.

Distribution of Coefficients of Intelligence for Normal Group (1282 Individuals)

Coefficients	AGE BY YEARS								Totals
	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-on	
.25 or less.....									0
.26- .50.....	4	6	3		2			1	16
.51- .60.....	4	7	10	1	1	1		1	25
.61- .70.....	4	15	13	7	3	3		16	61
.71- .80.....	8	26	21	15	10	3		31	114
.81- .90.....	10	36	25	23	12	8		68	182
.91-1.00.....	8	49	31	39	22	24	2	109	284
1.01-1.10.....	7	45	37	33	40	17	1	55	235
1.11-1.20.....	10	55	25	21	23	16		3	153
1.21-1.30.....	6	46	19	16	4	3			94
1.31-1.40.....	6	27	9	4	2	2			50
1.41-1.50.....	6	21	3	2	1				33
1.51-1.75.....	9	19							28
1.76-2.00.....	0	4							4
2.01-2.25.....	2	1							3
2.26-2.50.....									
Totals.....	84	357	196	161	120	77	3	284	1282

TABLE IV.

Intelligence Classification According to Coefficient of Intelligence, Based upon the Data for 1282 Individuals, Ranging in Age from 4 Years to Maturity

Coefficients	Name of Class	Frequency
.50 or less	Dependent	1.25 per centum
.51- .70	Inferior	6.96 " "
.71- .90	Subnormal	23.09 " "
.91-1.10	Normal	40.48 " "
1.11-1.30	Supernormal	19.27 " "
1.31-1.50	Superior	6.47 " "
1.51-	Genius	2.73 " "

On the basis of the facts of distribution indicated by Table 3, we have made a tentative classification of intellectual ability. This is presented in Table 4, in which are to be found seven classes, ranging from the intellectually dependent to the intellectual genius. For each of these classes, the range of coefficients is indicated and the frequency or expectation in percentage terms as determined by the distribution of twelve hundred and eighty-two normal-group coefficients. Because of the excessive variation in range exhibited by Table 3, we have presented, in Table 5, the frequency of these seven groups of coefficients for four hundred and seventy-seven normal-group coefficients obtained from subjects whose chronological ages ranged from eight to thirteen years.

TABLE V.

Intelligence Classification According to Coefficient of Intelligence, Based Upon the Data for 477 Individuals, Ranging in Age from 8 to 13 Years

Coefficients	Name of Class	Frequency
.50 or less	Dependent	1.05 per centum
.51- .70	Inferior	7.34 " "
.71- .90	Subnormal	22.22 " "
.91-1.10	Normal	42.35 " "
1.11-1.30	Supernormal	22.64 " "
1.31-1.50	Superior	4.40 " "
1.51-	Genius	.0 " "

We suggest this classification for certain practical purposes, hoping that it may be tried out in comparison with social measurements in order that we may determine with increasing definiteness the frequency of these significant levels of intellectual ability.

TABLE VI.

Distribution of Coefficients of Intelligence by Years, for Little Wanderers' Home Group (Hardwick)

Coefficients	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Totals
.25 or less		1						1									2
.26- .50		2	4	1					1	1							9
.51- .60	2	1	3			1											7
.61- .70			1			2	2	1			1		1	1	1		10
.71- .80		2	3	3		1			2	2			2		3	1	19
.81- .90				3	1	6	2	2	1	2	3	3			1	1	25
.91-1.00				2	3	4	3	3	1	4	3	1	1		1	1	27
1.01-1.10				1			1	2	1	1	2	4	4	2	1	1	20
1.11-1.20							1	1	1			2	1				6
1.21-1.30			2				1			1							4
1.31-1.40		1	1	1	1												4
1.41-1.50				1		1											2
Totals	2	7	14	12	5	15	10	10	7	11	9	10	9	3	7	4	135

In the group of one hundred and thirty-five individuals examined at the Little Wanderers' Home, there appear, as Table VI indicates, an unexpectedly large percentage of sub-normal and inferior individuals. Prior to the analysis of our data, we had assumed that this group of children should be classified as normal, but by comparison with the public school groups, they are so inferior that it is necessary to deal with the results separately or in connection with the Industrial School group. For this group, and likewise for the Industrial School group, as it appears in Table VII, age range is favorable to the coefficient, for the distribution under the several ages is reasonably constant.

TABLE VII.

Distribution of Coefficients of Intelligence for Ohio Industrial School Group (Haines)

Coefficients	10	11	12	13	14	15	16	17	18	19	Totals
.25 or less							1				1
.26- .50	1		1	1	3	7	6	1	2		22
.51- .60		2	4	11	19	9	8	12	3	1	69
.61- .70	1	3	1	9	19	25	12	28	16	2	116
.71- .80	1	5	10	16	28	53	38	43	24	2	220
.81- .90	4	6	12	18	32	49	44	38	18	1	222
.91-1.00	3	8	10	14	24	48	54	45	20		226
1.01-1.10		3	1	7	13	24	26	18	17		109
1.11-1.20	2	2		1	2	3	1	1			12
Totals	12	29	39	77	140	218	190	186	100	6	997

Since we are primarily interested in developing a method of expressing intellectual ability which shall be at once convenient and reliable and render possible direct comparison of measurements on different subjects, it is pertinent to consider here the relations of age-difference to coefficients of intelligence. It has long been recognized that a year of intellectual retardation or acceleration has widely varying values. Our data enable us to express this relation somewhat more exactly than has heretofore been done.

TABLE VIII.

Approximate Age-Difference Equivalents of Point-Scale Coefficient .70 for Various Ages

Age	Age-difference	Coefficient
5 years	-1.0 year	.70
6 "	-1.3 "	"
7 "	-1.5 "	"
8 "	-2.0 "	"
9 "	-1.3 "	"
10 "	-2.0 "	"
11 "	-2.5 "	"
12 "	-3.2 "	"
13 "	-4.0 "	"
14 "	-4.8 "	"
15 "	-5.6 "	"
16 "	-6.5 "	"
17 "	-7.4 "	"
18 "	-8.0 " +	"

The norm for nine years is inexact.

For the coefficient of intelligence .70, which we accept as the upper limit of intellectual inadequacy or inferiority, the age-difference equivalents for the ages five to eighteen years have been calculated and are presented in Table VIII. At five years of age, this coefficient represents a retardation in intellectual develop-

ment of approximately one year. At ten years of age, it represents a retardation of at least two years, and so on, until at the age of eighteen years it is equivalent to a retardation of approximately eight years. In view of this varying relation of coefficient to age-difference, it is eminently undesirable to continue to use the age unit as a means of expressing intellectual status.

A graphic representation of the relation of coefficients to age-difference appears as figure 1.

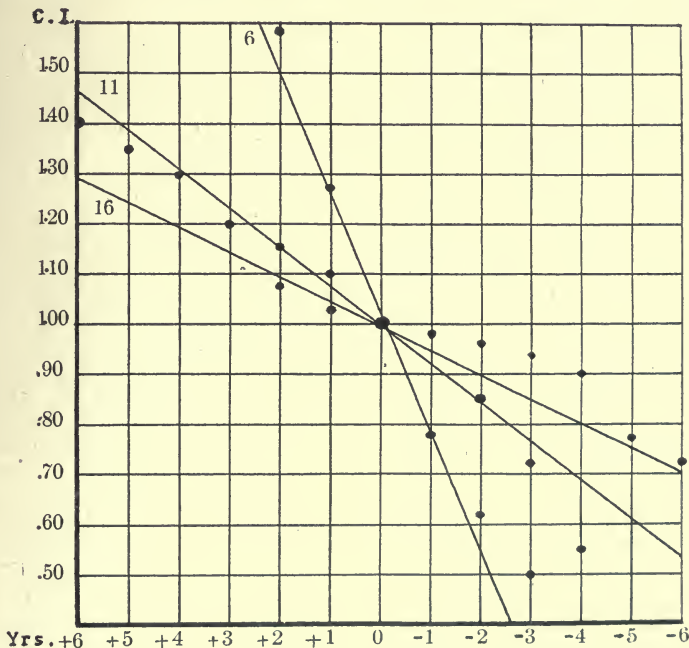


FIGURE 1—Age-difference in relation to coefficient of intelligence for the ages 6, 11 and 16 years.

The point-scale method has the merit of indicating directly the rate, or annual increments of intellectual growth. We do not claim for our measurements a high degree of accuracy, especially in case of the early years of childhood. But even the roughly determined curve of intellectual growth from four to eighteen years, which we present below, has considerable interest for the genetic psychologist and for the psychological examiner. We have ascertained that whether measured by the ratio of the

increment of increase, year by year, to the norm for the appropriate year or by the ratio of the extreme range of scores to appropriate year norms, intellectual development rapidly diminishes in rate, at least from the fifth year onward. This is shown by the curve of figure 2.

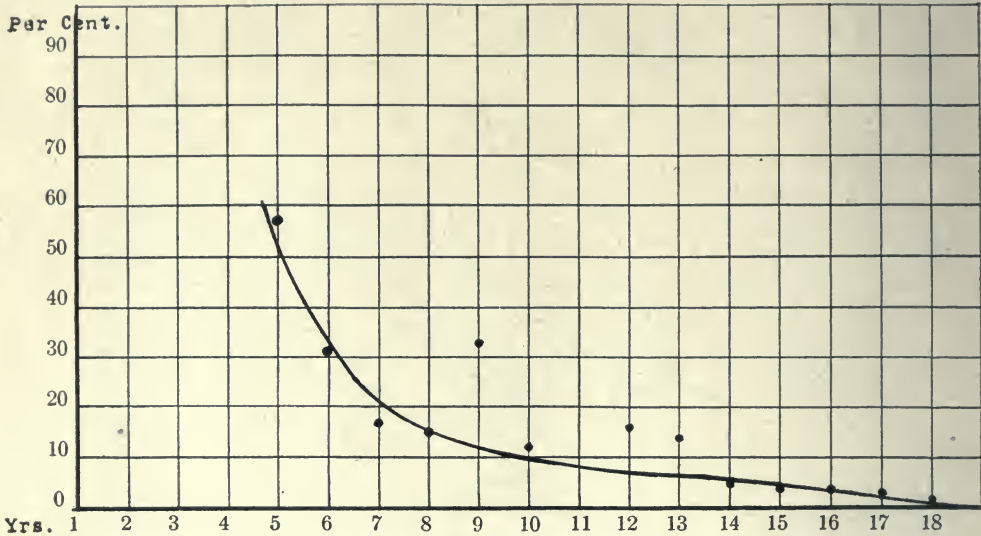


FIGURE 2—Curve of increase of intellectual ability based upon point-scale measurements.

During the fourth year of life, intellectual ability (always understood as measured by the point scale) increases by more than fifty per cent.; during the fifth year of life, by scarcely more than thirty per cent.; during the seventh year, by approximately fifteen per cent. It then develops less rapidly until in the thirteenth year it increases by only about five per cent. Our results further indicate that between sixteen and eighteen years the increase is slight and irregular, ceasing almost entirely at about eighteen years.

The application of a carefully constructed point scale to thousands of non-selected individuals evidently would yield most valuable information concerning psychogenesis, for curves might be plotted not only for examination scores but for measurements of particular functions. In this respect the point-scale method as an instrument of research has great superiority over the Binet age-grade method.

The data of Table VIII and those upon which figure 2 is based suggest an important reason for the greater range or variability of coefficients in early childhood than in adolescence. During the earlier years, intellectual ability is increasing very rapidly and any discrepancy between physiological and chronological age or any slight advantage or disadvantage in the conditions of mental measurement would naturally affect the score or coefficient of intelligence markedly, altering it by ten, twenty, or even thirty per cent. For a single case, we present the coefficients figured, first, without respect to months of age; second, with reference to exact age. A child five years, six months of age obtained a score of 45 points. The norm for the age five years is 22 points. The coefficient of intelligence is therefore 2.05. For this individual, when months as well as years are taken into account, the appropriate norm is 26 points, instead of 22, and the resultant coefficient of intelligence, 1.81.

The norms for point-scale measurements, as originally published in "A Point Scale for Measuring Mental Ability" are undoubtedly inaccurate. This is due partly to the small number of individuals in each age-group and partly to the unsatisfactoriness of the arithmetical mean as a norm. Since the norms were first published, thousands of examinations have been made by the method, and we have had opportunity to make various corrections. Unfortunately, our materials have been rather heterogeneous, and we are still unable to present a continuous series of age norms based upon comparable non-selected cases with supplementary information concerning deviations and probable errors. But despite the statistical shortcomings of our data, we deem it worth while to present herewith a new curve (figure 3) of point-scale norms ranging from four to eighteen years. Certain of these norms will doubtless have to be revised later, but we unhesitatingly recommend the present curve for English-speaking subjects as contrasted with the corresponding curve of the point-scale book.

APPLICATIONS AND RECOMMENDATIONS

The coefficient of intelligence (quotient) is the most valuable mode of expressing results of mental measurement at present available, and should, therefore, be used. Physiological age and norms appropriate thereto should be used as possible, instead

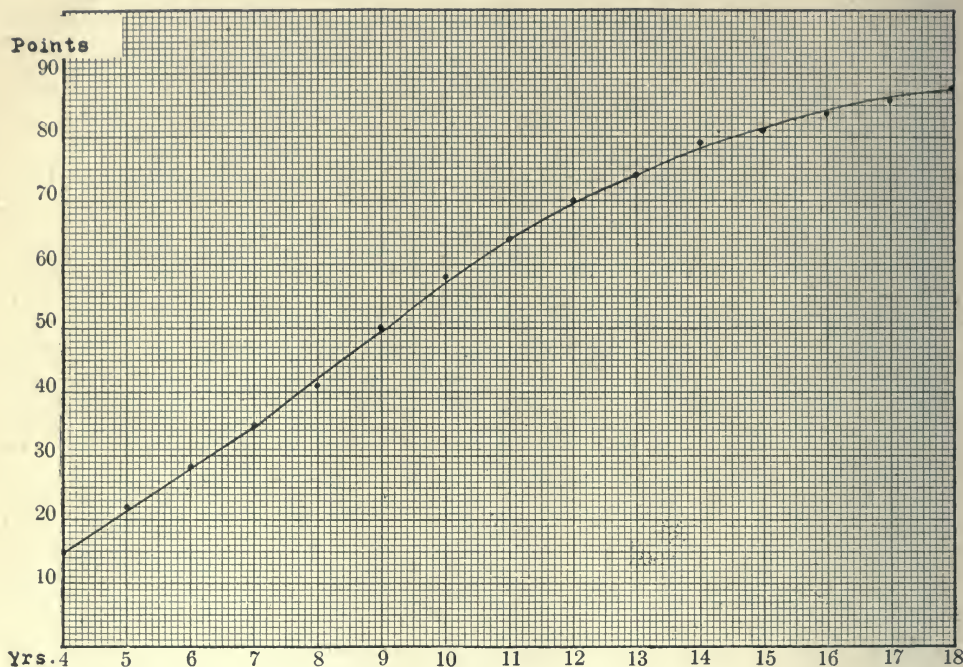


FIGURE 3—Revised point-scale norms for the ages 4 to 18 years (maturity).

of chronological age and the norms based upon the same. Frequency or rank is practically significant and should be stated. "Mental age" and age-difference as now employed are eminently unsatisfactory and should be abandoned as statements of intellectual status.

We recommend that the classification proposed in this paper be checked against social and economic measurements of individual efficiency and that the range of coefficients for the seven grades of intellect in our classification be adjusted to agree closely with expectation of performance in practical situations. Our data indicate that grades of intellectual ability measured by the coefficient .70 or less are socially burdensome, ineffective, and usually a menace to racial welfare.

COMMUNICATIONS AND DISCUSSIONS

THE COLLEGE FRESHMAN AND MATHEMATICS. SECOND REPORT

The first report given by the writer on the subject appeared in the April number of the JOURNAL OF EDUCATIONAL PSYCHOLOGY, and included data from two tests, namely, Series A and Series B of the Courtis Standard Tests in Arithmetic. The purpose of this report is to add some data obtained from tests dealing with fundamentals, and with easy reasoning in the various topics in college algebra, plane trigonometry, and analytic geometry. From this data it was hoped that some conclusion might be reached as to the efficiency to be obtained, depending on the text or texts chosen.

For several years it has been our custom in freshman mathematics to give approximately twelve weeks, four recitations per week of 55 minutes each, to each of the above named subjects in the order named, and to use different texts in different sections.

In the fall of 1915-16, each section consisted of exactly thirty students chosen at random. The section meeting at 8:00 o'clock studied Fite's College Algebra, Durell's Plane Trigonometry, Wilson and Tracy's Analytic Geometry. The section meeting at 2:30 o'clock studied Rietz and Crathorne's College Algebra, Conant's Plane Trigonometry, Bocher's Analytic Geometry. The similarity of the records obtained from Series A and Series B of the Courtis Standard Tests, indicated evenly matched sections, as did also other tests such as tendency to study, enthusiasm, ability to understand new methods, etc. The first of the standard tests in algebra was given on January 5th, 1916. It consisted of four parts, namely; No. 1, addition; No. 2, multiplication; No. 3, reduction to a common denominator; No. 4, factoring. The following are type problems:

No. 1. $12X + 10 - 7X - 6 + 8X + 8 - 5X + 7 =$

No. 2. $-6(8y - 16 + 7y + 13b) =$

No. 3. $\frac{5X - 7}{4} - \frac{3X - 8}{3} + \frac{X + 2}{12} =$

No. 4. $X^2 - 3X - 10 =$

A sufficient number of problems was given so that no one would be able to complete the work within the time allowed. Seven minutes

were given for the first test; four minutes for the second; $3\frac{1}{2}$ minutes for the third; seven minutes for the fourth. In tabulating the results the number attempted is indicated by Att. and the number correct by Rt.

Section	No. 1		No. 2		No. 3		No. 4	
	Att.	Rt.	Att.	Rt.	Att.	Rt.	Att.	Rt.
8:00 (o'clock)....	13.3	9.4	13	10.9	8.7	5.4	20	12.5
2:30 (o'clock)....	14.2	9.4	12.8	9.9	9.3	6	20	11.4

It will be seen that the average record in these fundamental operations is quite uniform. Yet the efficiency in solving more difficult problems was noticeably different. The 2:30 section constantly required more drill and more assistance outside the class hour. Although the spirit of this section was good, they frequently spoke of their inability to read the text, especially in the more difficult parts of the text. At the end of three months their efficiency was not over 90% of that of the other section and probably considerably less.

The data given below show the highest and also the lowest record in each section.

Section	No. 1		No. 2		No. 3		No. 4	
	Att.	Rt.	Att.	Rt.	Att.	Rt.	Att.	Rt.
8:00 (highest).....	20	18	21	19	15	12	40	29
(lowest).....	9	5	9	6	6	2	14	6
2:30 (highest).....	18	17	17	17	13	10	40	32
(lowest).....	8	1	4	0	5	0	5	1

The difference in efficiency between the highest and the lowest is very marked. Two of the three students with extremely low records failed badly in the final test, even after they had received much individual coaching. The semester grades in all subjects indicated that, in general, these fundamental tests in arithmetic and algebra had been fairly accurate tests of mentality as far as their accuracy and rapidity of thinking was concerned.

On March 7th the tests consisted of three parts: Nos. 5 and 6 were devoted to easy processes in algebra; No. 7, to fundamentals in trigonometry. In algebra the test covered L. C. M.; H. C. F.; Binomial Theorem; solving quadratic equations; forming equations whose roots were given; evaluating a determinate; etc. In trigonometry the test covered such questions as completing a formula when a part is given; functions of 30 degrees; easy identities; etc. The following results were obtained:

Section	No. 5		No. 6		No. 7	
	Att.	Rt.	Att.	Rt.	Att.	Rt.
8:00.....	12.5	6.8	11.5	5.9	11	7.5
2:30.....	12.1	6.4	9.2	4.4	9	6.7

The efficiency of the 2:30 section as indicated by these tests was probably about 85% of that of the 8:00 section. The difference between the highest and the lowest record did not indicate a greater degree of uniformity than at the beginning of the year. The last of the series of tests was given May 26th. Test No. 8 was merely test No. 7 repeated. Test No. 9 was made to cover fundamental principles and easy exercises in analytic geometry. For test No. 8, 12 minutes was given and for test No. 9, 11 minutes. The following results were obtained:

Section	No. 8		No. 9	
	Att.	Rt.	Att.	Rt.
8:00.....	12.55	7.7	11.25	7.81
2:30.....	9.54	7.05	8.66	4.33

It will be seen that the efficiency of the 2:30 section remained below that of the other section in trigonometry, and the lower standard in analytics is decidedly marked. Yet these results were in fairly close agreement with my personal grading.

After this test a strenuous effort was made to bring the 2:30 section to a higher standard. The success was only partial, and on June 4th, a final test over the semester's work, taking $2\frac{1}{2}$ hours time revealed the fact that there was still a difference of about 11%. I attribute the difference in the final standard of efficiency to the text or texts used.

Of the students who enrolled for calculus in September, 1916, exactly four-fifths came from the 8:00 section. Why teach mathematics from a poorly written text?

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MEASURES OF DIFFICULTY IN COMPLETION TESTS

May I venture to point out what appears to be a somewhat serious error in the June number of the JOURNAL OF EDUCATIONAL PSYCHOLOGY, in a paper entitled "*A Tentative Standardization of the Completion Test.*" On page 332, the authors make the following statement: "In other words, these three degrees of difficulty are purely subjective degrees determined by the observer, and hence the less frequently words are marked as of more than average difficulty, the more difficult they probably are compared with words of average difficulty, and the more value they should be assigned in comparison with the easier words. Hence the conclusion that the best method

of assigning the values to the different blanks of the test should be based on the frequency with which such degree of difficulty was specified by the different subjects." That is, the assumption is made that an inverse rectilinear relationship exists between the frequency with which a particular judgment of difficulty is given and the amount of difficulty which that judgment implies. While undoubtedly it is true that the more rarely a particular judgment, such as "more than average difficulty" is applied by a group of examiners to a series of samples, the more likely it is that the standard represented by "more than average difficulty" is high, yet to assume that an actual rectilinear relationship exists would seem contrary to all previous statistical work.

This can be clearly shown by an extreme example. Suppose we have one hundred individuals judging one hundred elisions by classifying them into samples of "average difficulty" and "more than average difficulty," and let us suppose that in the one hundred samples, all but one are of uniform difficulty with the rest; this one being of just sufficient increased difficulty to cause one judge to assign it to the group of "more than average difficulty." Then if we consider the 10,000 judgments, grouping all the individuals and all the judgments of the elisions together, *as in the original paper*, then

9999 of the judgments were given to group of "average difficulty"
 1 " " " " was given to group of "more than average difficulty"

Using the method of calculation which the authors employ, we should now conclude that the judgment "more than average difficulty" indicated an amount of difficulty 9999 times the amount implied by the term "average difficulty." This, on the surface, is absurd, yet it is precisely the method employed in the study, though there the error is not so obvious simply because it is veiled by not being shown in an extreme form.

If it is desired to determine the relative difficulties of the elisions or the judgments "average difficulty," more than average difficulty," "very difficult," the most direct method would be to measure the actual time taken by all the subjects for the completion of each of the elisions, then on the basis of these times defining the values of the difficulties.

It would not have been necessary to call attention to the above error had it not been so destructive of the final quantitative values which it was the aim of the paper to determine.

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VOLUME VII

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EDITORIAL

The translation into English under the auspices of the Vineland Training School of the papers of Alfred Binet and Th. Simon on *The Development of Intelligence in Children* and *The Intelligence of the Feeble-Minded* invites attention to Binet's life and influence. Binet's early training was along neurological and psychiatric lines—he was first a pupil of and then an assistant to the great Charcot. Attracted by the German experimental movement in psychology, he went to Germany in the early nineties, and on his return established the first laboratory for experimental psychology in France. From this laboratory, consisting of a few small, dark, poorly equipped rooms in an old dwelling house on a little side street, Binet for twenty years radiated a stimulating and broadening influence upon the psychological thinking not only of France but of the whole world.

The channels for the exercise of this influence were three fold: The *Année Psychologique*, the publication of books on various aspects of psychology, and the investigations of the *Société libre pour l'étude psychologique de l'enfant*. In the *Année* Binet and his associates published a number of articles each year, usually of a general rather than of a technical experimental nature, and gave a complete *resumé* of the progress of psychology during the preceding year. These

resumés furnish an excellent sketch of the development of the science, and will be valuable for the future historian of the subject. Binet's books cover a wide variety of topics, ranging from the psychology of micro-organisms, through suggestion, graphology, and chess playing, to the psychology of the reasoning processes. These were all written in a popularizing vein, and show none of the efforts at profundity that characterize most German and American books on psychology. Throughout his whole life Binet was greatly interested in educational problems, and a large amount of space in almost every volume of the *Année* was devoted to questions of a psycho-educational nature. His educational proclivities found immediate expression in the work of the *Société libre*, of which he was an active and zealous member.

Binet was not, perhaps, a great teacher. His lectures did not fill large auditoriums with eager proselytes, nor was his laboratory a training camp for a host of investigators, who made it their mission to enlarge the boundaries of the science, and to become centers of psychological research in other communities. Perhaps the conditions in France were not favorable for this. Experimental psychology in France has always meant medical psychology, and there seems to be little interest in the laboratory studies of normal individuals which have characterized the term in Germany and America. It would probably not be too much to say that Binet was never an experimentalist in the sense in which that term is understood in the laboratories of Wundt and Titchener. His work contains little of mathematical or statistical method. In studying his papers on measuring the intelligence of children the reader is oftentimes at a loss to know just what experimental work was done or how the resulting judgments were arrived at. The detailed steps of his procedure are passed over hastily, the methods of computation determining the final placing of tests are ignored. His attention was fixed on the final result, and he was perhaps too careless of the means by which the result was attained. His great service to psychology and education lay in the genius with which he seized upon great ideas and set them forth so that they stimulated the imagination and led to reflection and investigation.

J. C. B.

NOTES AND NEWS

Dr. Herman M. Adler, assistant professor of psychiatry, Harvard University, has commenced a study of the facilities for dealing with mental diseases and mental deficiency in Cook County, Illinois. The survey is under the general direction of the National Committee for Mental Hygiene and the expense will be met by the Rockefeller Foundation. A committee appointed by the mayor of New York City to present a constructive plan for the examination, classification and proper treatment of mental defectives has requested the National Committee for Mental Hygiene to make a similar survey of New York City. Thus studies of the same subject will be carried on simultaneously under the same general direction in the two largest cities of the country.—*Science*.

The Jesup Lectures of the American Museum of Natural History are being given this year by Professor Robert S. Woodworth, of Columbia University. The general subject is "Dynamic Psychology," and the subjects of the individual lectures, which are delivered on Friday evenings from November 10 to December 29, are as follows: "The Modern Movement in Psychology," "The Problems and Methods of Psychology," "Native Equipment of Man," "Acquired or Learned Equipment," "The Factor of Selection and Control," "The Factor of Originality," "Drive and Mechanism in Abnormal Behavior," and "Drive and Mechanism in Social Behavior."

On November 29-30 Professor W. C. Bagley delivered a series of six lectures before the North Carolina Teachers Assembly on the general subject of "Problems of Educational Psychology and Administration."

On December 9 Professor Guy M. Whipple addressed the forty-second semi-annual meeting of the New Jersey High School Teachers Association on the subject of "Standardization of Marks in High School Subjects."

In connection with the reorganization of the work in education at Johns Hopkins University the degree of Bachelor of Science is offered to those students who desire to emphasize education in their undergraduate work. The usual fifteen units are required for matricula-

tion, but the course is made as flexible as possible to permit of adjustment to the future work of the student. Courses are required in English, foreign languages, history and science, and in history of education, psychology, educational psychology, psychopathology, hygiene and political economy. Elections may be made in the fields of elementary or secondary teaching, supervision, or educational administration, but at least two courses are required in two teaching subjects.

The Board of Trustees of the University of Illinois has approved plans for a building for the school of education calling for a preliminary expenditure of \$600,000. Ground has already been broken for the erection of the first wing.

At the Culver (Indiana) Military Academy Professor Guy Montrose Whipple and other psychologists with selected cadets as assistants have been conducting experimental studies on the feasibility of mental tests as a means of diagnosing abilities in applicants for admission.

Dr. Bird T. Baldwin, professor of psychology and education at Swarthmore College, has been appointed lecturer in education at Johns Hopkins University. In addition to his work at Swarthmore, Dr. Baldwin will give a graduate course in physical and mental measurements, tests, and scales in the new University Administration Building at Homewood, Baltimore.

At the University of Washington, Dr. Leonard V. Koos has been made associate professor of education, and Dr. Clifford Woody has been appointed assistant professor in the same department.

Professor George O. Ferguson, Jr., of William and Mary College, has been appointed associate professor of psychology and education in Colgate University.—*School and Society*.

Mr. B. F. Pittenger, who was appointed associate in education at the University of Illinois for the current year, has accepted a position as adjunct professor of education in the University of Texas.

Professor W. H. Pyle, on leave of absence from the University of Missouri, is giving courses in educational psychology at the University of Indiana.

PUBLICATIONS RECEIVED

HENRY FOSTER ADAMS. *Advertising and Its Mental Laws*. New York: The Macmillan Company, 1916. Pp. xi, 333. \$1.50.

The work of Scott, Münsterberg, Hollingworth, Strong and Starch has caused attention to be focussed upon the psychology of business and upon advertising in particular, and has been productive of much interesting and valuable material anent the subject. It might seem daring to add another book at the present time to the considerable number already in the field, but the volume before us produces a very favorable impression. It is not a "one man book" by any means. The author has made very skillful use of the findings of previous investigators, and has furnished a reliable and scientifically constructed handbook. But it is not merely a compilation. The author has interesting investigations of his own to report on almost every topic. The aim of the book, as set forth in the preface, is "to present the basic principles of psychology which are related to advertising and to point out their application; to reduce the complexity of an advertisement to its elements and to show with mathematical exactness the effect of the various elements; and to compare the results of the experiments carried on in the laboratory with the results of actual advertising campaigns, showing the strikingly close relationship between the business and the theoretical test."—An ambitious undertaking, truly, but carried out with no inconsiderable degree of success.

FRED CARLETON AYER. *The Psychology of Drawing, with Special Reference to Laboratory Teaching*. Baltimore: Warwick & York, Ind., 1916. Pp. 172. \$1.25.

This is an important contribution to the literature of experimental education. The book consists of three parts: Part I, "The Scope of the Problem," is by way of introduction. Part II, "Survey of the Literature of Drawing," gives an excellent history of the subject to date. It includes a consideration of the methods of research, the relation of drawing to intellectual development, the analysis of the drawing product, and the analysis of the drawing act. It is particularly the latter chapter in which the psychologist is interested, and here one will find a good condensed account of the work of Albien, Meumann, and Judd. In Part III, "Experiments and Conclusions," there is an account of some interesting and significant studies on representative drawing, description, and diagrammatic or analytical drawing. Representative drawing the author finds useless for scientific purposes, and he condemns it as positively antagonistic to the development of scientific thinking. "The psychological analysis of the drawing act shows that there is great variation among different individuals in the ability to draw and in the manner in which graphic expression is utilized. Laboratory procedure must be adapted to these variations before the highest type of instruction is attainable." The investigation points the way to a saner and more efficient use of drawing in laboratory work in science.

ALFRED BINET AND TH. SIMON. *The Development of Intelligence in Children*. Translated by Elizabeth S. Kite. Publications of the Training School at Vineland, New Jersey, Department of Research, No. 11, May, 1916. Pp. 337. \$2.00.

ALFRED BINET AND TH. SIMON. *The Intelligence of the Feeble-Minded*. Translated by Elizabeth S. Kite. Publications of the Training School at Vineland, New Jersey, Department of Research, No. 12, June, 1916. Pp. 328. \$2.00.

Just as America owes to Dr. H. H. Goddard the first agitation for familiarity with and use of the Binet tests, so now she owes to his interest and initiative the publication of these two stately volumes containing translations of many of Binet's most important papers. In the past eight years the Binet tests and Binet testing have developed from a tentative psychological proposal to the formidable proportions of a veritable cult. In many institutions the use of the tests has become a routine procedure, and they have even been advocated as a means of grading in the public schools. Their indiscriminate and uncritical application by untrained and over-sanguine workers has led to sweeping conclusions and hasty judgments that a greater familiarity with Binet's original writings might have checked. These papers were scattered through various numbers of the *Année Psychologique*, a periodical not easily accessible, and presenting the barrier of the foreign language as a handicap to most readers. Through the labors of Miss Kite they are now made available to English readers. The first volume contains five articles, three from 1905 (the third one contains the 1905 tests), the 1908 revision of the tests, and a fifty-five page article discussing and explaining the 1911 revision. The second volume contains three parts: Part I, "The Intelligence of the Feeble-Minded," Part II, "The Language of the Feeble-Minded," and Part III, "Feeble-Mindedness and Dementia." All three of these papers date from 1908 and 1909. Like all of Binet's work, these papers contain many brilliant and stimulating reflections, and they should be carefully read by every one engaged in mental testing or interested in the problem of the sub-normal.

ERNST R. BRESLICH. *Second-Year Mathematics for Secondary Schools*. Chicago: The University of Chicago Press, 1916. Pp. xx, 348. \$1.00.

The experiment to do away with the traditional divisions of secondary mathematics into algebra and geometry, and to provide a unified mathematics course, such as the Germans have, is one that is being watched with great interest by many teachers of mathematics and students of current educational movements. The present book is intended to carry on the author's *First-Year Mathematics*, published last year, but it may also be used successfully in classes that have had only algebra during the first year. The emphasis is now

on geometry, just as the emphasis in the First-Year book was on algebra, yet there is abundant material calling for a review and extension of the algebra already studied. Further aims of the book are to train the student in space geometry as well as in plane geometry, and to give a good introduction to trigonometry. The commendable features of Book I, emphasis on the historical development of mathematics and the abundant use of illustrations from actual life, are continued in the present volume. The general plan of the book is so attractive that one has a desire to try it out immediately with a class.

ANTON JULIUS CARLSON. *The Control of Hunger in Health and Disease*. Chicago: The University of Chicago Press, 1916. Pp. vii, 319. \$2.00.

The past few years have witnessed a remarkably fertile activity in the field of physiology. The work of Sherrington on the functions of the nervous system, of Verworn on the irritability of nervous and muscular tissue, of Haldane on breathing, of Cannon on digestion, and now of Carlson on hunger has been of the first rank in enlarging our knowledge of the functioning of the human organism. The present book, while strictly scientific in its temper and treatment, takes account of some of the broader biological and social aspects of hunger, and is not too technical to be read with profit by the intelligent layman. Not a little of the interest of the book is derived from a detailed study of the stomach conditions of a man who has eaten nothing for twenty years. At the age of eleven, as a result of accidentally drinking a strong solution of caustic soda, his esophagus was permanently closed, and since then he has been obliged to feed himself through a tube opening directly into the stomach. This opening is large enough to permit direct inspection of the interior of the stomach, and has afforded an excellent opportunity to study the physiology of hunger.

THOMAS CHROWDER CHAMBERLIN. *The Origin of the Earth*. Chicago: The University of Chicago Press, 1916. Pp. xi, 271. \$1.50.

The origin of the earth has provoked the imagination ever since the dawn of human thinking. Almost every people has its creation myth, every child sooner or later wrestles with the problem, and scientific discussions of the subject make a strong popular appeal. The prevailing theory is that the earth was once a molten, nebulous, gaseous mass at an extremely high temperature, and that the solidification of the earth's crust has come about through a process of cooling and condensation. Recent studies of the behavior of gases, however, have made such a theory increasingly untenable, and in the present book the author submits it to a searching critical analysis from every possible point of view. His own theory is too elaborate to be expounded here, but the essence of it is that the earth grew up largely by the accession of planetesimal dust after it had been wafted to and fro by the atmosphere. The accessions were solid matter, and remained solid except as specific conditions enforcing liquefaction arose

and reduced selected portions to the molten state. The author's final word is "that what we conveniently regard as merely material is at the same time spiritual, that what we try to reduce to the mechanistic is at the same time volitional, but whether this be so or not, the emergence of what we call the living from the inorganic, and the emergence of what we call the psychic from the physiologic, were at once the transcendent and the transcendental features of the earth's evolution."

EDWIN LEAVITT CLARKE. *American Men of Letters, Their Nature and Nurture*. New York: Columbia University Studies in History, Economics and Public Law. Longmans, Green & Co., Agents, 1916. Pp. 169. \$1.50.

This important study took its rise from the theory of the significance of education enunciated in Ward's *Applied Sociology*. An introductory chapter outlines representative views on the relation of heredity and environment in the production of great men, taking Galton, Ward and Cooley as types. One thousand of the most eminent American men of letters, born before 1850, were selected for careful study. The author's concluding thesis is: "In all ranks of American society there have been found men and women of literary ability. Much of this ability has been found in members of the same families, but it has been the monopoly of neither a select group of families nor of a peculiar national strain. This latent ability has been brought to light by favorable environmental influences, of which there are two distinct kinds. One kind may be called education, or training, and includes those influences of home and school which are particularly potent during childhood and youth. The other kind includes all the remaining elements of environment, especially the ideals and customs of the group in which one lives. Possession of even the best advantages at home and in school has made possible the development of great authors only when supplemented by this second factor of the environment. In short, men of letters have appeared chiefly when the society of their time has appreciated and demanded literature."

GEORGE VAN NESS DEARBORN. *How to Learn Easily. Practical Hints on Economical Study*. Boston: Little, Brown & Co., 1916. Pp. xi, 227.

This is a series of most entertainingly written papers on the essentials of study. Chapter I, *Economy in Study*, develops the doctrine of interest and satisfaction in learning, and enumerates many of the factors involved in raising this satisfaction to the maximum. Chapter II, *Observation and the Taking of Notes*, lays weight on the importance of so-called "sense training," and the utilization of previous experiences through the aid of written records. If one desires to fix in mind the plot of an ordinary story the best way to do it is to make a written abstract of it. There are many helpful suggestions on note taking and note using. Other chapters are entitled "Educative Imagination," "Books and their Educative Use," "Is your 'Thinker' in Order," and "Examination-Preparedness." "Originality, ingenuity, grace, skill are terms for various phases of the productive and

efficient constructive imagination. We may suggest a working rule for becoming able in this line of constructive imagination, even if it be in almost slang terms: Get posted; get energetic; get interested; get busy; and try. And keep on trying."

STEPHEN PIERCE DUGGAN. *A Student's Text-book in the History of Education*. New York: D. Appleton and Company, 1916. Pp. xiii, 398. \$1.25.

All student's histories of education must necessarily be much alike. The most important differences are those in points of view and relative emphasis. The aims of the author in constructing the present text were as follows: Practical assistance to the teacher in giving him a better understanding of present-day problems in education; emphasis on modern education, particularly the tendencies of the present time; it is a history of education, not a history of pedagogy; it aims to explain how western civilization developed the educational ideals, content, organization, and practices which characterize it today. It has for its primary purpose the explanation of the way in which each people has worked out the solution of the great problem that has confronted every people at all times, in all places, and in all stages of development, namely, the reconciliation of individual liberty with social stability. In keeping with these aims we find chapters on present tendencies in education, discussing education for defectives, the Montessori system, the Gary system, school surveys, and Dewey's educational theories; and on national systems of education, sketching the history of education in the last century in America, Germany, France and England. The increase in the cost of paper is probably the reason for the rather inferior quality of stock on which the book is printed.

JOHN WILLIAM HALL AND ALICE CYNTHIA KING HALL. *The Question as a Factor in Teaching*. Boston: Houghton Mifflin Company, 1916. Pp. viii, 189.

The major portion of this book is taken up with the use of the question in teaching stories to children of the first five grades. In his introduction Professor Frank McMurry says, that in school and college procedure there is little use for the question except as a test of results after the learning process is supposed to have been completed. In most text-books the questions come in only at the end of the chapter. In practical life the procedure is reversed. No one thinks of undertaking anything except in response to a question. "Answers alone, without the problems that called them forth, would be absurd. So in the field of business in general, of politics, and of scientific investigation, questions necessarily precede answers; they are prerequisite to all thinking; they supply the motive for the effort as well as the basis for the selection and organization of the data. They are the key to the situation, determining the value that shall be attached to the answer itself." The final chapter deals somewhat cursorily with the question as a factor in teaching other subjects, as history, composition, manual training, reading, and arithmetic.

NELLIE P. HEWINS. *The Doctrine of Formal Discipline in the Light of Experimental Investigation*. Educational Psychology Monographs, No. 16. Baltimore: Warwick and York, Inc., 1916. Pp. viii, 120. \$1.25.

The first 48 pages of this monograph are devoted to a summary of psychological and pedagogical experiments on the subject of formal discipline. These are classified as follows: Psychological, (1) Effect of training of one kind of sensitiveness on other kinds; (2) Effect of special training on the general rapidity and accuracy of motor adjustments; (3) Effect of special training on the general rapidity and accuracy of memorizing; (4) Effect of training of one organ upon the bilaterally symmetrical one, or closely related member. Pedagogical, (1) Mathematics; (2) Spelling; (3) English Grammar; (4) Mental traits; (A) Memory, (B) Habits, (C) Concentration of attention, (D) Observation, (E) Quickness, accuracy, attention, etc., (F) Ideas of method, (G) Ideals. The latter part of the monograph gives an account of the author's own experiments with three classes of freshman pupils in a New York City high school on "the training of observation" in biology work. There were three series of thirteen tests each, and they included such material as observation of a twig, a picture, a flower, nonsense syllables, a branch of lilac leaves, a nonsense figure, a chart of geometrical figures, a figure drawn in the air, and specimens of plants, flowers and vegetables. The results gave decisive evidence of improvement in one type of observation carried over to other kinds. The book is a valuable contribution to this much disputed topic.

HARRY L. HOLLINGWORTH. *Vocational Psychology: Its Problems and Methods*. New York: D. Appleton and Company, 1916. Pp. xviii, 308. \$2.00.

In view of the current interest in the psychology of business, in vocational and educational guidance, and in the obligation of the schools not only to offer training in specific lines, but to help the pupil discover the kind of work for which he is best adapted and to assist him in making the best possible preparation for that work, the present book is very opportune. The scheme of the book is indicated by the chapter headings, some of the most important of which are as follows: Motives and antecedents of vocational psychology; search for phrenological and physiognomic principles; development of psychological tests; psychographic methods; special vocational tests; self-analysis and estimates of associates; the school curriculum as a vocational test; determinants of vocational aptitude; vocational aptitudes of women; and psychological tests as applied to vocational analysis. The ultimate goal of vocational psychology is the detailed and accurate determination of the traits involved in every form of productivity, and such tests for these traits in any individual that both employee and employer may know to what extent the individual

possesses the traits desired. The author admits that as yet we are far from this goal. But the very fact that such a systematic presentation of the aims of the science and the work already done has now been made is an indication of great promise for the future development of the subject.

WILLIAM HEARD KILPATRICK. *Froebel's Kindergarten Principles Critically Examined*. New York: The Macmillan Company, 1916. Pp. xii, 217. \$.90.

"The general aim of this book is to help spread the reform of kindergarten theory and practice. Its appeal is accordingly not only to kindergartners and to the general student of educational theory, but as well to superintendents and other directors of educational practice. The complete kindergarten reform must be the work of all. Until the superintendent can know and properly value what goes on in the kindergarten, his part in improving conditions will be negligible or worse. The kindergartner herself will prove efficient in bettering affairs in the proportion that she can see and appraise what she does. Until the general student of education can place the theory of the kindergarten into its proper correlation with an all-inclusive educational theory, until that time will the kindergarten exist as a thing apart, ill connected with other educational endeavor." The author devotes two chapters to the examination of the principles underlying Froebel's educational doctrines, and one each to Froebel's educational psychology, the kindergarten gifts and occupations, and additional elements of the kindergarten curriculum.

HERBERT SIDNEY LANGFELD AND FLOYD HENRY ALLPORT. *An Elementary Laboratory Course in Psychology*. Boston: Houghton Mifflin Company, 1916. Pp. xvi, 147. \$1.75.

The aim of this laboratory manual is simplification. The authors have selected seventy-eight experiments, a few of which require elaborate apparatus, and all of which have such specific and complete directions that they can be performed by the novice in psychology. The book is replete with illustrations of apparatus, plans for tabulating the results, and reproductions of test blanks. As a substitution test the authors have introduced the Continental Wireless Telegraph Code. The book follows the traditional classification: Sensation (33 experiments) perception (22), attention (2), motor processes (2), association (2), memory 9, imagery (3), and affection (5). The experiments that might have some significance for the educationist are span of perception (with an elaborate description of the Dearborn-Langfeld tachistoscope), the synthesis of successive perceptions in perceiving words and meanings, fixation of attention in word perception, influence of form in word perception, skeleton words, determining tendency in perceiving words, errors of perception (neglect of misspelling), strength of attention, free chain association, detection of suppressed ideas, and the nine memory experiments.

JOHN T. McMANIS. *The Study of the Behavior of the Individual Child*. Baltimore: Warwick and York, Inc., 1916. Pp. 54. \$.75.

It must be admitted that the traditional psychology of the textbooks is extremely abstract and very far removed from the situations which the teacher is called upon to meet. This abstractness and aloofness of the subject is causing teachers of psychology in normal and training schools to reflect seriously upon the results of their work, and to modify it in such a manner as to make it function more immediately in the tasks of teaching. The present volume is the outcome of such an effort. The author, who is professor of education in the Chicago Normal College, devised this syllabus to assist prospective teachers in classes in education to understand child life in the city. "In doing this work it has been found more effective to study individual cases rather than the child as a type or children in general." The topics considered are general method, physical conditions, home conditions, plays and games, instinctive activities, outside interests, school life, mental characteristics and disposition, learning process, language, drawing, movements and motor ability, moral characteristics, and the exceptional child. Each topic has a brief introductory discussion, a study outline, and a selected bibliography. The bibliographies are especially to be commended as well-chosen, up-to-date, and excellently adapted to give the reader a thorough-going orientation in the subject. The use of this book in normal schools will do much to make the subject of child study of practical value to the young teacher.

CYRUS D. MEAD. *The Relations of General Intelligence to Certain Mental and Physical Traits*. Teachers College Contributions to Education, No. 76. New York: Teachers College, Columbia University, 1916. Pp. 117. \$1.50.

"This series of studies represents data collected and tests made upon about 430 feeble-minded children of the Indiana School for Feeble-Minded Youth at Fort Wayne and 480 normal children of the Caldwell, New Jersey, public schools." Chapters two and three on the age of walking and talking in relation to general intelligence and on height and weight of children in relation to general intelligence have already appeared in the *Pedagogical Seminary*. The other chapters of this monograph deal with strength of grip, dexterity, perception, and memory in relation to general intelligence. In all the functions tested the normal subjects make a better showing than the feeble-minded.

GEORGE ORDAHL. *A Study of Fifty-three Male Convicts*. Reprinted from the Journal of Delinquency, Vol. 1, No. 1, March, 1916. Pp. 21.

This is a study of some of the convicts in the Joliet penitentiary, Joliet, Illinois. The study includes an examination of the prison records, a detailed account of the prisoner's life history as given by himself, and the application of the Binet tests for the determination

of intelligence. Fourteen of the prisoners are said to have committed their crimes either because of, or under conditions of, such a low grade of mentality as to warrant the application of the term feeble-minded. There is an interesting discussion of the significance of the Binet tests for this purpose, and while the author considers them the best means available, he emphasizes the need for finer laboratory tests and more scientific means of observation of general behavior.

MAURICE PARMELEE. *Poverty and Social Progress*. New York: The Macmillan Company, 1916. Pp. xv, 477. \$1.75.

This is a scholarly and closely reasoned study of the causes of poverty and its significance for society. Under causes and conditions the author discusses biological factors; diseases of the body; mental infirmities; the distribution of wealth; standards of living; the extent of poverty; statistics and causes of unemployment; the sweating system and other labor conditions causing poverty; population and poverty; and political, domestic, and matrimonial maladjustments. The latter half of the book is devoted to a discussion of remedial and preventive measures, among which the author enumerates the modern humanitarian movement, private and public philanthropy, the care of dependents and defectives, eugenic education, thrift, social insurance, regulation of wages and the labor supply, redistribution of income from ownership of property, increasing the productiveness of society, industrial democracy, political reorganization of the democratic state, and a final chapter on social progress and the coming of the normal life. One of the most interesting chapters in the book is that dealing with eugenics propaganda. The author emphasizes the play function of sex and shows the futility of attempting to reduce sex relations to the specific end of the propagation of the species.

MARY L. READ. *The Mothercraft Manual*. Boston: Little, Brown and Company, 1916. Pp. xix, 440. \$1.25.

This is a meaty and practical book on a most important topic. The author, who is director of the School of Mothercraft, New York, enumerates the following ideals that have been kept in mind in its preparation: "To write a handbook that is so definite, concrete and clear that the least experienced person of average intelligence will find it practical; to bring directly to those who have opportunity to use it some of the wealth of present knowledge in biology, dietetics, hygiene, domestic efficiency, child psychology, and education that is stored in the laboratories, research reports, medical records, technical journals, and educational classics, translating these from the obscure tongue of technical language into the clearer speech of daily life; to present fundamental principles and facts rather than mere rule of thumb procedure; to keep a progressive yet reserved attitude between conservative and radical theories; and to lighten the burden and enlighten the minds and hearts of earnest young people so that with joy and satisfaction they may essay and find the home and family life that their hearts desire." We know of no other book that attains so nearly to these ideals, that contains so much valuable material

for the prospective mother, for the care of early infancy, and for the nurture and development of the young child. An appendix provides an excellent bibliography of 43 pages.

HAROLD ORDWAY RUGG. *The Experimental Determination of Mental Discipline in School Studies*. Educational Psychology Monographs, No. 17. Baltimore: Warwick and York, Inc., 1916. Pp. ix, 132. \$1.25.

The subject of the general effects of special training shows no diminution of power to attract the attention of students of education. Indeed there are evidences that the experimental investigation of this topic is only at its beginning. The present volume is noteworthy in two respects: First, it presents in condensed, tabular form the results of the important studies on the subject up to the present time; second, it gives an account of the most elaborate experiment ever undertaken to determine the spread of improvement in a school subject to types of activity of a markedly different nature. It is somewhat surprising to note that prior to 1890 no empirical study of the problem of mental discipline had been made, and up to 1900 only three studies were published—all of a formal, psychological nature. In the past sixteen years, however, thirty experimental studies have been published, and six of these have had to do with school activities. The experiment reported in this monograph dealt with the effects of the study of descriptive geometry upon "the quickness and accuracy with which the verbal description of different types of spatial elements (whether plane figures or three dimensional objects) raises in consciousness and maintains and manipulates in consciousness a corresponding mental picture or spatial 'visual image.'" The method was that of parallel groups, one the training group, the other the control group. Both groups were given the test series immediately before the training was begun, and immediately after it was ended. The results showed that there was a greater gain on the part of the trained group than of the untrained group, that the greater gain was slight in non-geometrical abilities and became increasingly greater as one passed to those partaking more and more of geometrical qualities, and that the gainers of the trained group gained in a distinctly larger proportion of the tests than did those of the untrained group.

W. CARSON RYAN, JR. *Education Exhibits at the Panama-Pacific Exposition, San Francisco, California, 1916*. Bulletin, 1916, No. 1. Washington: Bureau of Education, 1916. Pp. 116. 25c.

A detailed account of the educational exhibits with a large number of excellent photographs showing their precise nature.

WILLIAM A. STECHER. *Games and Dances*. Philadelphia: John Joseph McVey, 1916. Pp. xiv, 255. \$1.50.

The book contains detailed directions for over 250 games arranged according to the age of children, the conditions under which the games may be played, and other needs. Music and words are given for the games and musical accompaniments for the dances. The book constitutes a very valuable manual for physical education.



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